SPX®
WHERE IDEAS MEET INDUSTRY

INSTRUCTION MANUAL

CombiTherm

Centrifugal pump for thermal oil / hot water applications

CT/EN (1406) 1.0

Orginal instructions
Read and understand this manual prior to operating or servicing this product

Johnson Pump®

EC Declaration of conformity

(Directive 2006/42/EC, appendix II-A)

Manufacturer

SPX Flow Technology Assen B.V.
Dr. A.F. Philipsweg 51
9403 AD Assen
The Netherlands

hereby declares that all pumps member of productfamilies CombiBloc, CombiBlocHorti, CombiChem, CombiDirt, CombiFlex(U)(B), CombiPrime H, CombiLine, CombiLineBloc, CombiMag, CombiMagBloc, CombiNorm, CombiPro(L)(M)(V), CombiPrime V, CombiSump, CombiTherm, CombiWell, FRE, FRES, FREF, FREM, KGE(L), KGEF, HCR, MCH(W)(S), MCHZ(W)(S), MCV(S), PHA, MDR whether delivered without drive (last position of serial number = B), or delivered as an assembly with drive (last position of serial number = A), are in conformity with the provisions of Directive 2006/42/EC (as altered most recently) and where applicable the following directives and standards:

- EC directive 2006/95/EG, "Electric equipment for use within certain voltage limits"
- standards EN-ISO 12100 part 1 & 2, EN 809

The pumps to which this declaration refers may only be put into operation after they have been installed in the way prescribed by the manufacturer, and, as the case may be, after the complete system of which these pumps form part, has been made to fulfil the requirements of Directive 2006/42/EC (as altered most recently).

Declaration of incorporation

(Directive 2006/42/EC, appendix II-B)

Manufacturer

SPX Flow Technology Assen B.V.
Dr. A.F. Philipsweg 51
9403 AD Assen
The Netherlands

hereby declares that the partly completed pump (Back-Pull-Out unit), member of productfamilies CombiBloc, CombiBlocHorti, CombiChem, CombiDirt, CombiFlex(U)(B), CombiPrime H, CombiLine, CombiLineBloc, CombiMag, CombiMagBloc, CombiNorm, CombiPro(L)(M)(V), CombiTherm, CombiPrime V, FRE, FRES, FREF, FREM, KGE(L), KGEF, HCR, PHA, MDR is in conformity with the following standards:

- EN-ISO 12100 parts 1 & 2, EN 809

and that this partly completed pump is meant to be incorporated into the specified pump unit and may only be put into use after the complete machine of which the pump under consideration forms part has been made and declared to comply with that directive.

Assen, June 1st 2014

G.A. Schaafsma,

General Manager

Instruction manual

All technical and technological information in this manual as well as possible drawings made available by us remain our property and shall not be used (otherwise than for the operation of this pump), copied, duplicated, made available to or brought to the notice of third parties without our prior written consent.

SPX is a Fortune 500, global multi-industry manufacturing leader. SPX divides its business into four segments and one of these is the SPX Flow Technology segment. SPX Flow Technology Assen B.V. is part of SPX Flow Technology segment.

SPX Flow Technology Assen B.V.
P.O. Box 9
9400 AA Assen
The Netherlands

Tel. +31 (0)592 376767
Fax. +31 (0)592 376760

Copyright © 2008 SPX Corporation

Table of Contents

1	**Introduction**	**9**
1.1	Preface	9
1.2	Safety	9
1.3	Guarantee	10
1.4	Inspection of delivered items	10
1.5	Instructions for transport and storage	10
1.5.1	Dimensions and weight	10
1.5.2	Use of pallets	10
1.5.3	Hoisting	11
1.5.4	Storage	11
1.6	Ordering parts	12
2	**General**	**13**
2.1	Pump description	13
2.2	Applications	13
2.3	Type code	14
2.4	Serial number	14
2.5	Bearing groups	14
2.6	Construction	15
2.6.1	Pump casing / impeller	15
2.6.2	Shaft seal	15
2.6.3	Bearing	15
2.7	Application area	15
2.8	Re-use	16
2.9	Scrapping	16
3	**Installation**	**17**
3.1	Safety	17
3.2	Preservation	17
3.3	Environment	17
3.4	Mounting	18
3.4.1	Installation of a pump unit	18
3.4.2	Assembling a pump unit	18
3.4.3	Alignment of the coupling	18
3.4.4	Tolerances for aligning the coupling	19
3.5	Piping	20
3.6	Accessories	20
3.7	Connection of the electric motor	21
3.8	Combustion engine	21
3.8.1	Safety	21

3.8.2 Sense of rotation 21

4 Commissioning 23

4.1 Inspection of the pump 23
4.2 Inspection of the motor 23
4.3 Preparing the pump unit for commissioning 23
4.4 Checking the sense of rotation 23
4.5 Start-up 24
4.6 Pump in operation 24
4.7 Noise 24

5 Maintenance 25

5.1 Daily maintenance 25
5.2 Mechanical seal 25
5.3 Lubrication of the bearings 25
5.4 Environmental influences 25
5.5 Noise 25
5.6 Motor 26
5.7 Faults 26

6 Problem solving 27

7 Disassembly and assembly 29

7.1 Precautionary measures 29
7.2 Special tools 29
7.3 Liquid draining 29
7.4 Back-Pull-Out system 30
7.4.1 Disassembling the guard 30
7.4.2 Disassembling the Back-Pull-Out unit 30
7.4.3 Assembling the Back-Pull-Out unit 30
7.4.4 Assembling the guard 31
7.5 Replacing the impeller and the wear ring 33
7.5.1 Disassembling the impeller 33
7.5.2 Mounting the impeller 33
7.5.3 Disassembling the wear ring 34
7.5.4 Assembling the wear ring 34
7.6 Bearings L1, L2 and mechanical seal M1, M5 35
7.6.1 Instructions for disassembly of bearings 35
7.6.2 Disassembling bearing L1 and mechanical seal M1, M5 35
7.6.3 Disassembling bearing L2 and mechanical seal M1, M5 36
7.6.4 Instructions for mounting a mechanical seal 37
7.6.5 Instructions for assembly of bearings 37
7.6.6 Assembling bearing L1 and mechanical seal M1, M5 37
7.6.7 Assembling bearing L2 and mechanical seal M1, M5 38

8 Dimensions 41

8.1 Base plate dimensions and weights 41
8.2 Connections 41
8.3 Pump dimensions 42
8.4 Pump-motor unit with standard coupling 44
8.5 Pump-motor unit with spacer coupling 46

9 Parts 49

9.1 Ordering parts 49
9.1.1 Order form 49
9.1.2 Recommended spare parts 49

9.2	Pump L1	50
9.2.1	Sectional drawing L1	50
9.2.2	Parts list L1	51
9.3	Pump L2	52
9.3.1	Sectional drawing L2	52
9.3.2	Parts list L2	53
9.4	Shaft sealing group M1	54
9.4.1	Mechanical seal MG12-G60	54
9.4.2	Parts list shaft sealing group M1	54
9.5	Shaft sealing group M5	55
9.5.1	Mechanical seal HJ92N	55
9.5.2	Parts list shaft sealing group M5	55
10	**Technical data**	**57**
10.1	Tightening moments	57
10.1.1	Tightening moments for bolts and nuts	57
10.1.2	Tightening moments for cap nut	57
10.2	Maximum allowable working pressures	57
10.3	Maximum speed	58
10.4	Temperature dissipation in the pump	58
10.5	Pressure near the impeller hub	59
10.6	Permissible forces and moments on the flanges	60
10.7	Hydraulic performance	62
10.8	Noise data	64
10.8.1	Pump noise as a function of pump power	64
10.8.2	Noise level of entire pump unit	65
	Index	**67**
	Order form for spare parts	**69**

1 Introduction

1.1 Preface

This manual is intended for technicians and maintenance staff and for those who are in charge of ordering spare parts.

This manual contains important and useful information for the proper operation and maintenance of this pump. It also contains important instructions to prevent potential accidents and damage, and to ensure safe and fault-free operation of this pump.

! **Read this manual carefully before commissioning the pump, familiarize yourself with the operation of the pump and strictly obey the instructions!**

The data published here comply with the most recent information at the time of going to press. However they may be subject to later modifications.

SPX reserves the right to change the construction and design of the products at any time without being obliged to change earlier deliveries accordingly.

1.2 Safety

This manual contains instructions for working safely with the pump. Operators and maintenance staff must be familiar with these instructions.
Installation, operation and maintenance has to be done by qualified and well prepared personnel.

Below is a list of the symbols used for those instructions and their meaning:

⚠ ***Personal danger for the user. Strict and prompt observance of the corresponding instruction is imperative!***

! **Risk of damage or poor operation of the pump. Follow the corresponding instruction to avoid this risk.**

➢ *Useful instruction or tip for the user.*

Items which require extra attention are shown in **bold print**.

This manual has been compiled by SPX with the utmost care. Nevertheless SPX cannot guarantee the completeness of this information and therefore assumes no liability for possible deficiencies in this manual. The buyer/user shall at all times be responsible for testing the information and for taking any additional and/or deviating safety measures. SPX reserves the right to change safety instructions.

1.3 Guarantee

SPX shall not be bound to any guarantee other than the guarantee accepted by SPX. In particular, SPX will not assume any liability for explicit and/or implicit guarantees such as but not limited to the marketability and/or suitability of the products supplied.

The guarantee will be cancelled immediately and legally if:

- Service and/or maintenance is not undertaken in strict accordance with the instructions.
- The pump is not installed and operated in accordance with the instructions.
- Necessary repairs are not undertaken by our personnel or are undertaken without our prior written permission.
- Modifications are made to the products supplied without our prior written permission.
- The spare parts used are not original SPX parts.
- Additives or lubricants used are other than those prescribed.
- The products supplied are not used in accordance with their nature and/or purpose.
- The products supplied have been used amateurishly, carelessly, improperly and/or negligently.
- The products supplied become defective due to external circumstances beyond our control.

All parts which are liable to wear are excluded from guarantee. Furthermore, all deliveries are subject to our "General conditions of delivery and payment", which will be forwarded to you free of charge on request.

1.4 Inspection of delivered items

Check the consignment immediately on arrival for damage and conformity with the advice note. In case of damage and/or missing parts, have a report drawn up by the carrier at once.

1.5 Instructions for transport and storage

1.5.1 Dimensions and weight

A pump or a pump unit is generally too heavy to be moved by hand. Therefore, use the correct transport and lifting equipment. Dimensions and weight of the pump or pump unit are shown on the label on the cover of this manual.

1.5.2 Use of pallets

Usually a pump or pump unit is shipped on a pallet. Leave it on the pallet as long as possible to avoid damages and to facilitate possible internal transport.

! When using a forklift always set the forks as far apart as possible and lift the package with both forks to prevent it from toppling over! Avoid jolting the pump when moving it!

1.5.3 Hoisting

When hoisting a pump or complete pump units the straps must be fixed in accordance with figure 1 and figure 2.

⚠ ***When lifting a pump or a complete pump unit always use a proper and sound lifting device, approved to bear the total weight of the load!***

⚠ ***Never go underneath a load that is being lifted!***

! **If the electric motor is provided with a lifting eye, this lifting eye is intended only for the purpose of carrying out service activities to the electric motor! The lifting eye is designed to bear the weight of the electric motor only! It is NOT permitted to lift a complete pump unit at the lifting eye of an electric motor!**

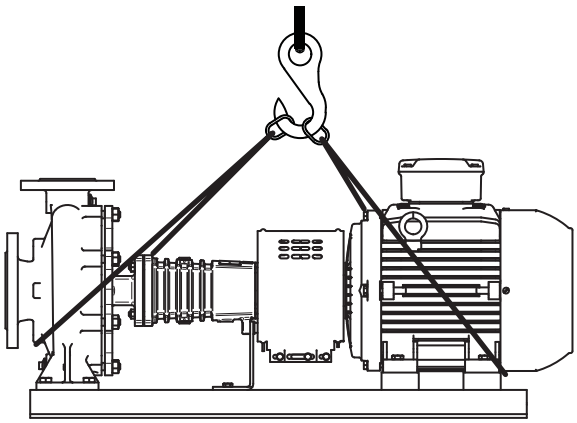

Figure 1: Lifting instructions for pump unit.

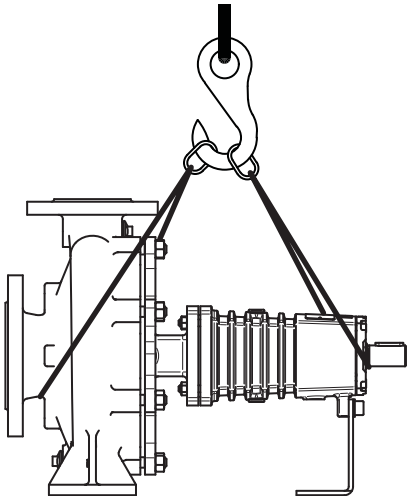

Figure 2: Lifting instructions for single pump.

1.5.4 Storage

If the pump is not to be used immediately the pump shaft must be turned by hand twice per week.

1.6 Ordering parts

This manual contains a survey of the spare parts recommended by SPX as well as the instructions for ordering them. A fax-order form is included in this manual.

You should always state all data stamped on the type plate when ordering parts and in any other correspondence regarding the pump.

➢ *This data is also printed on the label on the front of this manual.*

If you have any questions or require further information with regard to specific subjects, then do not hesitate to contact SPX.

2 General

2.1 Pump description

CombiTherm represents a range of centrifugal pumps, used in heat transfer systems (DIN 4754) or in hot water circulation systems, which meet ratings and main dimensions to EN 733 (DIN 24255).

Flange dimensions, bolt circle and number of holes comply with ISO 7005 PN16.

The pump is driven by a standard IEC foot motor. The power is transmitted through a flexible coupling. Because of their modular lay-out, constructional components are widely interchangeable, also with other pump types of the Combi system.

2.2 Applications

- Thermal oil circulation and Heat transfer.
- High temperature hot water circulation, hospitals, heating systems.
- The maximum allowed system pressure and temperature and the maximum speed depend on the pump type and the pump construction. For relevant data see paragraph 10.2 "Maximum allowable working pressures".
- Further details about the application possibilities of your specific pump are mentioned in the order confirmation and/or in the data sheet enclosed with the delivery.
- Do not use the pump for purposes other than those for which it is delivered without prior consultation with your supplier.

⚠ ***Using a pump in a system or under system conditions (liquid, working pressure, temperature, etc.) for which it has not been designed may hazard the user!***

2.3 Type code

Pumps are available in various designs. The main characteristics of the pump are shown in the type code.

Example: **CT 40-200 NG1 M1/T L1**

Pump family	
CT	**C**ombi**T**herm
Pump size	
40-200	diameter discharge connection [mm] - nominal impeller diameter [mm]
Pump casing material	
NG	nodular cast iron
Impeller material	
1	cast iron
6	stainless steel
Shaft sealing	
M1/T	mechanical seal, unbalanced, elastomers Viton®
M1/H	mechanical seal, unbalanced, elastomers EPDM
M5/T	mechanical seal, balanced, elastomers Kalrez® KH
M5/H	mechanical seal, balanced, elastomers Kalrez® K15
Bearing	
L1	sealed deep-groove ball-bearing, grease lubricated (2Z)
L2	double row angular contact ball bearing, grease lubricated (2Z)

2.4 Serial number

Serial number of the pump or pump unit are shown on the name plate off the pump and on the label on the cover of this manual.

Example: **01-1000675A**

01	year of manufacture
100067	unique number
5	number of pumps
A	pump with motor
B	pump with free shaft end

2.5 Bearing groups

The pump range is divided in a number of bearing groups.

Table 1: Bearing group division.

Bearing groups	
1	**2**
32-160	65A-250
32C-160	80C-200
32-200	80-250
32C-200	100-160
32-250	100C-200
40C-160	100C-250
40C-200	125-250
40-250	
50C-160	

Table 1: Bearing group division.

Bearing groups	
1	**2**
50C-200	
50-250	
65C-160	
65C-200	
80C-160	

2.6 Construction

The pump has a modular design. The main components are:

- Pump casing / impeller
- Shaft sealing
- Bearing

The pumps are divided into two bearing groups. Each bearing group only has one pump shaft and one bearing arrangement.

The pumps are also standardized into five groups with the same connection for the pump casing and pump cover, depending on the nominal impeller diameters. The bearing bracket is mounted to the pump cover.

2.6.1 Pump casing / impeller

This concerns the parts that are exposed to the pumped liquid. For each individual pump type there is only one design of the pump casing and the impeller. The pump casing is available in nodular cast iron, the impeller is available in cast iron, bronze or stainless steel. All pump types have a closed impeller design.

2.6.2 Shaft seal

The pump is provided with a mechanical seal with mounting dimensions according to EN 12756. Only 2 diameters are used for the whole range: d1 = 35 mm or 45 mm.

2.6.3 Bearing

The pumps are designed with a ball bearing and a slide bearing in the pumped liquid. The ball bearing can be supplied in a design with deep-groove ball-bearing or a double-row angular contact ball-bearing. All bearing types are grease lubricated with high temperature grease and sealed for life (2Z bearings). The bearings do not require any maintenance.

2.7 Application area

The application area globally looks as follows:,

Table 2: Application area.

	Maximum value
Capacity	400 m^3/h
Discharge head	160 m
System pressure	16 bar
Temperature	thermal oil 350 °C
	hot water 190 °C

2.8 Re-use

The pump may only be used for other applications after prior consultation with SPX or your supplier. Since the lastly pumped medium is not always known, the following instructions should be observed:

1 Flush the pump properly.

2 Make sure the flushing liquid is discharged safely (environment!)

⚠ ***Take adequate precautions and use the appropriate personal protection means like rubber gloves and spectacles!***

2.9 Scrapping

If it has been decided to scrap a pump, the same flushing procedure as described for Re-use should be followed.

3 Installation

3.1 Safety

- Read this manual carefully prior to installation and commissioning. Non-observance of these instructions can result in serious damage to the pump and this will not be covered under the terms of our guarantee. Follow the instructions given step by step.
- Ensure that the pump can not be started if work has to be undertaken to the pump during installation and the rotating parts are insufficiently guarded.
- Depending on the design the pumps are suitable for liquids with a temperature of up to 350°C. When installing the pump unit to work at 65°C and above the user should ensure that appropriate protection measures and warnings are fitted to prevent contact with the hot pump parts.
- If there is danger of static electricity, the entire pump unit must be earthed.
- If the pumped liquid is harmful to men or the environment, take appropriate measures to drain the pump safely. Possible leakage liquid from the shaft seal should also be discharged safely.

3.2 Preservation

When the pomp is temporarily put into storage, in order to prevent corrosion, must be preserved with commercially available preservatives. Please observe the manufacturer's instructions for application/removal.

3.3 Environment

- The foundation must be hard, level and flat.
- The area in which the pump is installed must be sufficiently ventilated. An ambient temperature or air humidity which is too high, or a dusty environment, can have a detrimental effect on the operation of the electric motor.
- There should be sufficient space around the pump unit to operate and if necessary repair it.
- Behind the cooling air inlet of the motor there must be a free area of at least ¼ of the electric motor diameter, to ensure unobstructed air supply.
- The pump casing take on the same temperature as the fluid handled, insulate the pump casing.

! Never insulate the pump cover and bearing bracket.

3.4 Mounting

3.4.1 Installation of a pump unit

Pump and motor shafts of complete pump units are adjusted perfectly in line in the works.

1 In case of permanent arrangement place the base plate level on the foundation with the aid of shims.

2 Carefully tighten the nuts on the foundation bolts.

3 Check the alignment of pump and motor shafts and if necessary realign, see paragraph 3.4.3 "Alignment of the coupling".

3.4.2 Assembling a pump unit

If the pump and the electric motor still have to be assembled, do the following:

1 Fit both halves of the coupling to the pump shaft and the motor shaft respectively.

2 If size **db** of the pump, see figure 17, is not equal to the IEC size of the motor, level up the difference by placing properly sized spacers under the pump or under the motor feet.

3 Place the pump on the base plate. Fix the pump to the base plate.

4 Place the electric motor on the base plate. Move the motor to obtain a gap of 3 mm between both coupling halves.

5 Place copper shims under the feet of the electric motor. Fix the electric motor to the base plate.

6 Align the coupling in accordance with the following instructions.

3.4.3 Alignment of the coupling

1 Place a ruler (A) on the coupling. Place or remove as many copper shims as is necessary to bring the electric motor to the correct height so that the straight edge touches both coupling halves over the entire length, see figure 3.

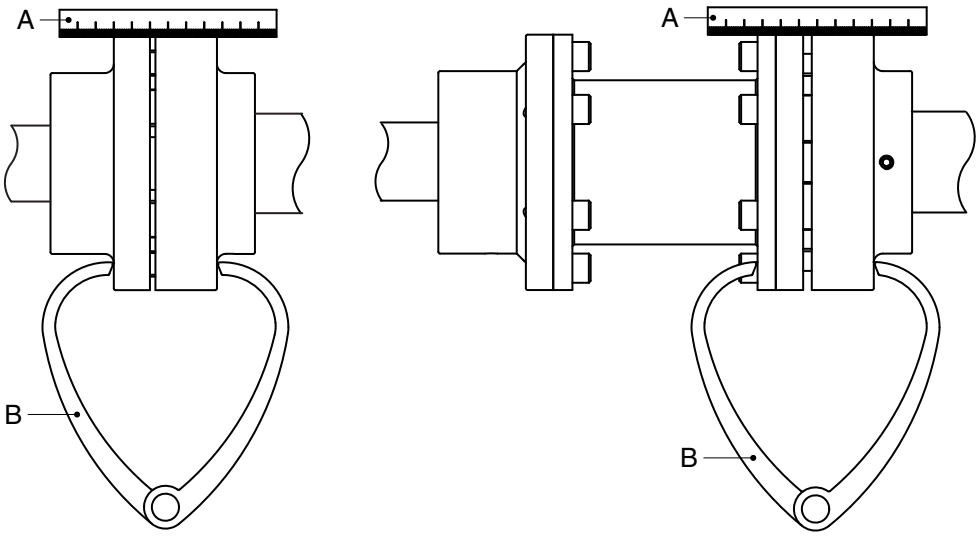

Figure 3: Aligning the coupling by means of a ruler and a pair of outside calipers.

2 Repeat the same check on both sides of the coupling at the height of the shaft. Move the electric motor so that the straight edge touches both coupling halves over the entire length.

3 Check the alignment once again using a pair of external callipers (B) at 2 diametrical opposite points on the sides of the coupling halves, see figure 3.

4 Fit the guard. See paragraph 7.4.4 "Assembling the guard".

3.4.4 Tolerances for aligning the coupling

The maximum allowable tolerances for the alignment of the coupling halves are shown in Table 3. See also figure 4.

Table 3: Alignment tolerances

External diameter of coupling [mm]	V				Va_{max} - Va_{min} [mm]	Vr_{max} [mm]
	min [mm]		max [mm]			
81-95	2	5*	4	6*	0,15	0,15
96-110	2	5*	4	6*	0,18	0,18
111-130	2	5*	4	6*	0,21	0,21
131-140	2	5*	4	6*	0,24	0,24
141-160	2	6*	6	7*	0,27	0,27
161-180	2	6*	6	7*	0,30	0,30
181-200	2	6*	6	7*	0,34	0,34
201-225	2	6*	6	7*	0,38	0,38

*) = coupling with spacer

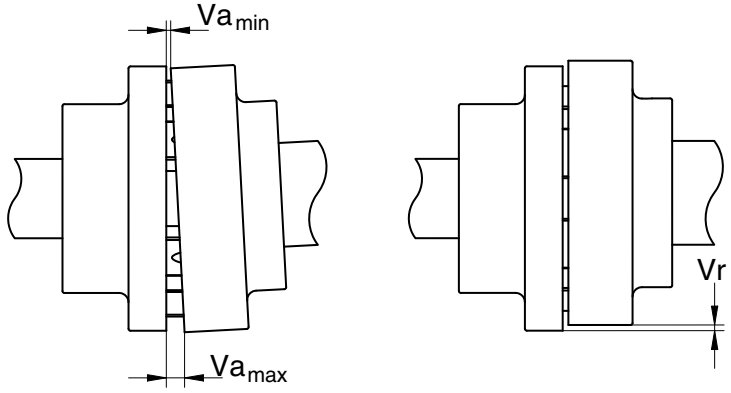

Figure 4: Alignment tolerances standard coupling.

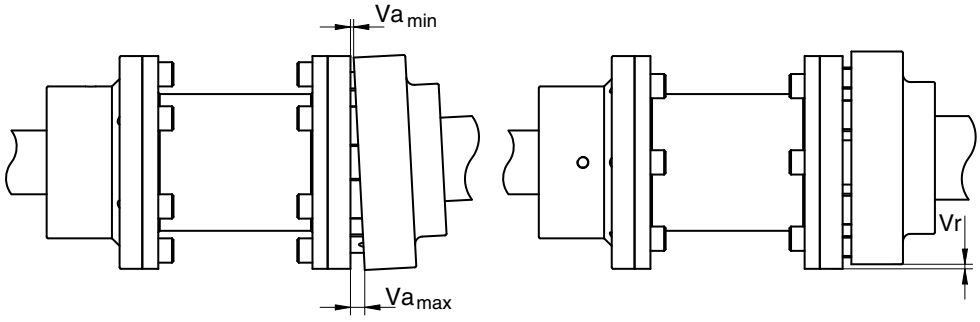

Figure 5: Alignment tolerances spacer coupling.

3.5 Piping

- The piping to the suction and delivery connections must fit exactly and must not be subject to stress during operation. For the maximum allowable forces and moments on the pump flanges see paragraph 10.6 "Permissible forces and moments on the flanges".
- The passage of the suction pipe must be amply dimensioned. This pipe should be as short as possible and run towards the pump in such a way that no air pockets can arise. If this is not possible, a venting facility should be provided at the highest point of the pipe. If the inside diameter of the suction pipe is larger than the suction connection of the pump, an eccentric reducer should be applied to prevent air pockets and whirls. See figure 6.

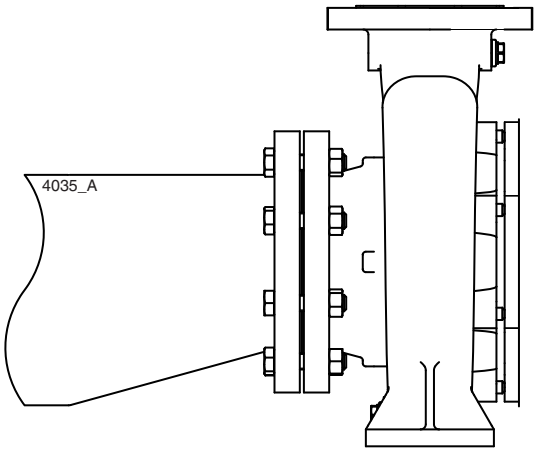

Figure 6: Eccentric reducer to suction flange.

- The maximum allowable system pressure is stated in paragraph 10.2 "Maximum allowable working pressures". If there is a risk that this pressure might be exceeded, for instance because of an excessive inlet pressure, appropriate measures should be taken by mounting a safety valve in the piping.
- Sudden changes in the rate of flow can lead to high pressure impulses in the pump and the piping (water shock). Therefore, do not use quick-acting closing devices, valves etc.

3.6 Accessories

- Fit any parts that may have been supplied separately.
- If the liquid does not flow towards the pump, fit a foot valve at the bottom of the suction pipe. If necessary, combine this foot valve with a suction strainer to prevent impurities from being drawn in.
- When mounting, place temporarily (for the first 24 operating hours) a fine gauze between suction flange and suction pipe to prevent internal pump parts from being damaged by foreign matter. If the risk of damage continues to exist, fit a permanent filter.

3.7 Connection of the electric motor

⚠ ***The electric motor must be connected to the mains by an approved electrician, according to the locally prevailing regulations of the electricity company.***

- Refer to the instruction manual belonging to the electric motor.
- If possible, fit a working switch as close as possible to the pump.

⚠ ***Only use electric motors whose cooling air flows axial direction towards the pump end.***

3.8 Combustion engine

⚠ ***Only use engines whose cooling air is sucking in or blown out via the coupling.***

3.8.1 Safety

If the pump set is designed with a combustion engine, the manual for the engine should be included in the delivery. If the manual is missing we urgently request you to contact us immediately.

- Irrespective of the manual, the following points should be observed for all combustion engines:
- Comply with the local safety regulations.
- The exhaust of combustion gases must be screened off to prevent incidental contact.
- The starting device should automatically be disengaged after the engine has been started.
- The maximum speed of the engine set by us should **not** be changed.
- Before starting the engine check the oil level.

3.8.2 Sense of rotation

The sense of rotation of combustion engine and pump is indicated by means of an arrow on the combustion engine and the pump casing. Verify whether the sense of rotation of the combustion engine is the same as that of the pump.

4 Commissioning

4.1 Inspection of the pump

- Check whether the pump shaft turns freely. Do this by turning the shaft end at the coupling a few times by hand.

4.2 Inspection of the motor

⚠ ***The cooling air flows axial direction towards the pump end should never be blocked.***

Pump driven by an electric motor:

- Check whether the fuses have been mounted.

Pump driven by a combustion engine:

- Check whether the room in which the engine is placed is well ventilated.
- Check whether the exhaust of the engine is not obstructed.
- Before starting the engine check the oil level.
- **Never run the engine in a closed room.**

4.3 Preparing the pump unit for commissioning

Proceed as follows, both when the unit is put into operation for the first time and after the pump has been overhauled:

1 Fully open the stop valve in the suction pipe. Close the delivery stop valve.

2 Fill the pump and the suction pipe with the liquid to be pumped.

3 Remove plug (2130) fill the bearing bracket with the liquid to be pumped.

4 Turn the pump shaft a few times by hand and add more liquid, if necessary.

5 Refit the plug.

4.4 Checking the sense of rotation

⚠ ***Beware of possible non-screened rotating parts, when checking the sense of rotation!***

1 The sense of rotation of the pump is indicated by an arrow. Check whether the sense of rotation of the motor corresponds with that of the pump.

2 Let the motor run for only a short time and check the sense of rotation.

3 If the sense of rotation is **not** correct, alter the sense of rotation. See the instructions in the user manual belonging to the electric motor.

4 Fit the guard.

4.5 Start-up

1 Start the pump.

2 As soon as the pump is under pressure, slowly open the delivery stop valve until the working pressure is attained.

⚠ ***Make sure that when a pump is running, rotating parts are always properly screened off by the guard!***

4.6 Pump in operation

When the pump is in operation, pay attention to the following:

- The pump should never run dry.
- Never use a stop valve in the suction line to control pump output. The stop valve should always be fully opened during operation.
- Check whether the absolute inlet pressure is sufficient, to prevent vaporization in the pump.
- Check whether the pressure difference between suction and delivery side corresponds with the specifications of the pump's duty point.

! **In the run-in phase of the pump, it is recommended to vent the pump several times through the plug on the bearing bracket.**

4.7 Noise

The noise production of a pump depends to a great extent on the operating conditions. The values stated in paragraph 10.8 "Noise data" are based on normal operation of the pump, driven by an electric motor. In case the pump is driven by a combustion engine, or in case it is used outside the normal operation area, as well as in case of cavitation, the noise level may exceed 85 dB(A). In that case precautions should be taken, like building a noise-barrier around the unit or wearing hearing protection.

5 Maintenance

5.1 Daily maintenance

Regularly check the outlet pressure.

⚠ ***No water should get into the terminal box of the electric motor when the pump room is sprayed clean! Never spray water on hot pump parts! The sudden cooling down may cause them to burst and hot water may flow out!***

! **Flawed maintenance will result in shorter lifespan, possible break down and in any event loss of warranty.**

5.2 Mechanical seal

A mechanical seal generally requires no maintenance, however, **it should never be allowed to run dry**. If there are no problems, do not dismantle the mechanical seal. As the seal faces have run in on one another dismantling usually implicates replacement of the mechanical seal. If a mechanical seal shows any leakage it has to be replaced.

5.3 Lubrication of the bearings

- The drive-end bearing (2240) are grease lubricated with high temperature grease and sealed for life (2Z bearings).
- The pump-end bearing bush (2230) is lubricated by the fluid handled.
- The bearings do not require any maintenance.
- It is recommended to replace the bearings after 2 years of operation or 16.000 operating hours.

5.4 Environmental influences

- Regularly clean the filter in the suction pipe or the suction strainer at the bottom of the suction pipe, as the inlet pressure may become too low if the filter or the suction strainer is fouled.
- If there is a risk that the pumped liquid expands during solidification or freezing, the pump has to be drained and, if necessary, flushed after it has been put out of service.
- If the pump is out of service for a long time, it has to be preserved.
- Check motor for accumulation of dust or dirt, which might influence motor temperature.

5.5 Noise

If a pump starts making noise, this may point to certain problems with the pump unit. A crackling noise can indicate cavitation or excessive motor noise can indicate deterioration of the bearings.

5.6 Motor

Check motor specifications for start-stop frequency.

5.7 Faults

⚠ ***The pump, of which you want to determine the fault, may be hot or under pressure. Take the appropriate precautions first and protect yourself with the proper safety devices (safety goggles, gloves, protective clothing)!***

To determine the source of the malfunctioning of the pump, proceed as follows:

1 Switch off the power supply to the pump unit. Lock the working switch with a padlock or remove the fuse. In case of a combustion engine: switch off the engine and close the fuel supply to the engine.

2 Close the stop valves.

3 Determine the nature of the fault.

4 Try to determine the cause of the fault with chapter 6 "Problem solving" and take the appropriate measures or contact your installer.

6 Problem solving

Faults in a pump installation can have various causes. The fault may not be in the pump, it may also be caused by the pipe system or the operating conditions. Firstly, always check that installation has been executed in accordance with the instructions in this manual and that the operating conditions still correspond with the specifications for which the pump was purchased.

In general, breakdowns in a pump installation are attributable to the following causes:

- Faults with the pump.
- Breakdowns or faults in the pipe system.
- Faults due to incorrect installation or commissioning.
- Faults due to incorrect choice of pump.

A number of the most frequently occurring failures as well as their possible causes are shown in the table below.

Table 4: Most frequently occurring failures.

Most common faults	**Possible causes, see Table 5.**
Pump delivers no liquid	1 2 3 4 8 9 10 11 13 14 17 19 20 21 29
Pump has insufficient volume flow	1 2 3 4 8 9 10 11 13 14 15 17 19 20 21 28 29
Pump has insufficient head	2 4 13 14 17 19 28 29
Pump stops after start up	1 2 3 4 8 9 10 11
Pump has higher power consumption than normal	12 15 16 17 18 22 23 24 25 26 27 32 38
Pump has lower power consumption than normal	13 14 15 16 17 18 20 21 28 29
Mechanical seal have to be replaced to often	23 25 26 30 32 33
Pump vibrates or is noisy	1 9 10 11 15 18 19 20 22 23 24 25 26 27 29 37 38
Bearings wear too much or become hot	23 24 25 26 27 37 38 42
Pump running rough hot or seizes	23 24 25 26 27 37 38 42

Table 5: Possible causes of pump failures.

	Possible causes
1	Pump or suction pipe is not sufficiently filled or de-aerated
2	Gas or air coming from the liquid
3	Air lock in the suction pipe
4	Air leak in the suction pipe
8	The manometric suction head is too high
9	Suction pipe or suction strainer is blocked
10	Insufficient immersion of foot valve or suction pipe during operation of the pump
11	NPSH available too low
12	Speed too high
13	Speed too low
14	Wrong sense of rotation
15	Pump does not operate at the right duty point
16	Liquid density differs from the calculated liquid density
17	Liquid viscosity differs from the calculated liquid viscosity
18	Pump operates when the liquid flow is too low
19	Wrong pump selection
20	Obstruction in impeller or pump casing
21	Obstruction in the piping
22	Wrong installation of the pump unit
23	Pump and motor not well aligned
24	Rotating part running out of true
25	Imbalance in rotating parts (for instance: impeller or coupling)
26	Pump shaft is running out of true
27	Bearings faulty or worn out
28	Casing wear ring faulty or worn out
29	Damaged impeller
30	Pump shaft on the spot of the seal faces of the mechanical seal are worn out or damaged
32	Bad mounting of the mechanical seal
33	Mechanical seal not suitable for the pumped liquid or operation circumstances
37	Axial retaining of impeller or pump shaft is defective
38	The bearings have been mounted wrongly
42	Too high axial force because of worn dorsal blades or excessive inlet pressure

7 Disassembly and assembly

7.1 Precautionary measures

⚠ ***Take adequate measures to avoid that the motor is started while you are working on the pump. This is especially important for electric motors with remote control:***

- Switch the operating switch near the pump (if available) to "OFF".
- Switch off the pump switch on the switchboard.
- If necessary remove the fuses.
- Hang a danger board near the switchboard cabinet.

⚠ ***The pump must have cooled down to ambient temperature.***

7.2 Special tools

Assembly and disassembly work requires no special tools. However, such tools can make certain jobs easier, for instance replacing the shaft seal. If such is the case it will be indicated in the text.

7.3 Liquid draining

! **Make sure no liquid or oil gets into the environment!**

Before starting any disassembly the pump should be drained.

1 If necessary, close the valves in the suction and delivery pipe.

2 Remove the drain plugs (0310) and (2150).

3 If harmful liquids are pumped wear protective gloves, shoes, glasses, etc., and thoroughly flush the pump.

4 Refit the drain plugs.

⚠ ***If possible, wear protective gloves. Regular contact with oil products may result in allergic reactions.***

7.4 Back-Pull-Out system

The pumps are designed with a Back-Pull-Out system. If the pump unit is designed with a spacer-coupling, just remove the spacer. After that the bearing bracket with the entire rotating part can be removed. This means that almost the whole pump can be dismantled without having to detach the suction and delivery piping. The motor remains in its position.

If the pump unit does not have a spacer coupling, the motor has to be removed from the foundation before disassembly.

7.4.1 Disassembling the guard

1 Loosen bolts (0960). See figure 10.

2 Remove both jackets (0270). See figure 8.

7.4.2 Disassembling the Back-Pull-Out unit

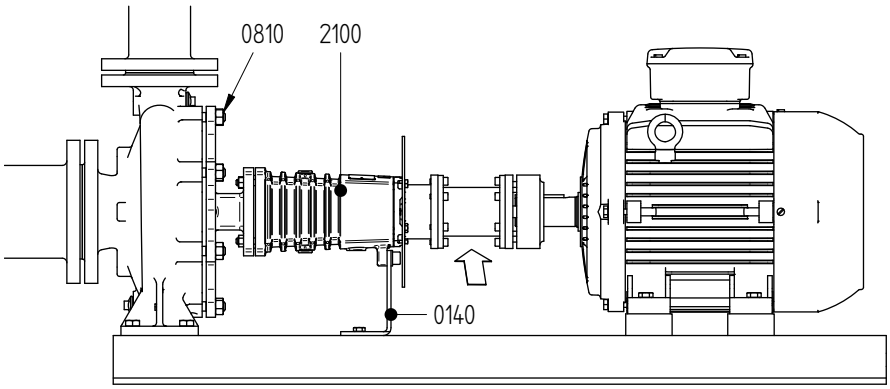

Figure 7: Back-Pull-Out principle.

1 Mounted with spacer coupling: Remove the spacer. Else: Remove the electric motor.

2 Loosen the bracket support (0140) from the base plate, see figure 7.

3 Remove the nuts (0810).

4 Pull the entire bearing bracket (2100) from the pump casing. The entire bearing bracket of large pumps is very heavy. Support it with a beam or hang it in a pulley sling.

5 Remove the coupling half from the pump shaft with a coupling puller and remove the coupling key (2210).

6 Unscrew bolts (0940) and remove the assembly plate (0275) from the bearing cover (2110). See figure 11.

7.4.3 Assembling the Back-Pull-Out unit

1 Fit a new gasket (0300) into the pump casing and fit the entire bearing bracket back into the pump casing.

2 Fit the nuts (0810) and tighten them crosswise with the proper tightening torque. See paragraph 10.1 "Tightening moments".

3 Fix the bearing support (0140) on the base plate.

4 Fit the assembly plate (0275) to the bearing cover (2110) with bolts (0940). See figure 11.

5 Fit the coupling key (2210) and fit the coupling half onto the pump shaft.

6 Place the motor back in its place or fit the spacer of the spacer coupling.

7 Check the alignment of pump and motor shaft, see paragraph 3.4.3 "Alignment of the coupling". If necessary, realign.

7.4.4 Assembling the guard

1 Fit the jacket (0270) at motor side. The annular groove must be located at motor side.

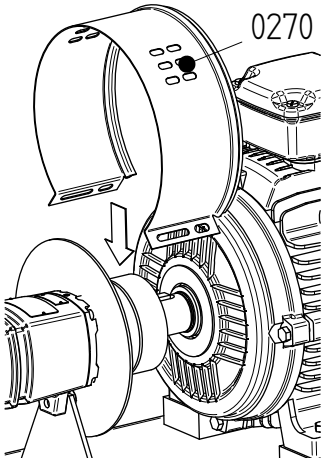

Figure 8: Fitting the jacket at motor side.

2 Place the assembly plate (0280) over the motor shaft and fit it into the annular groove of the jacket.

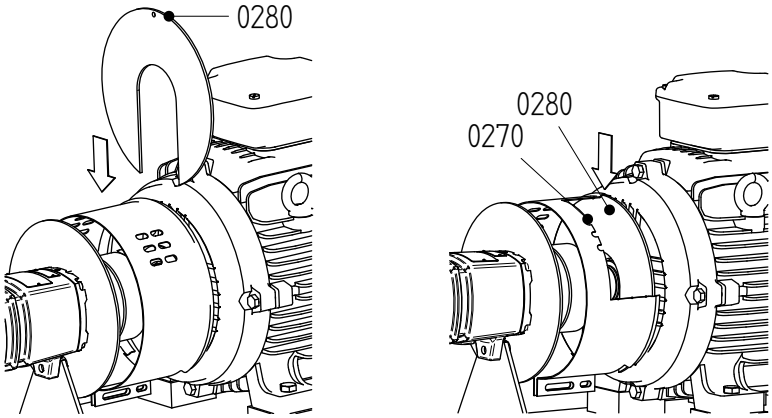

Figure 9: Fitting the assembly plate at motor side.

3 Close the jacket and fit bolt (0960). See figure 10.

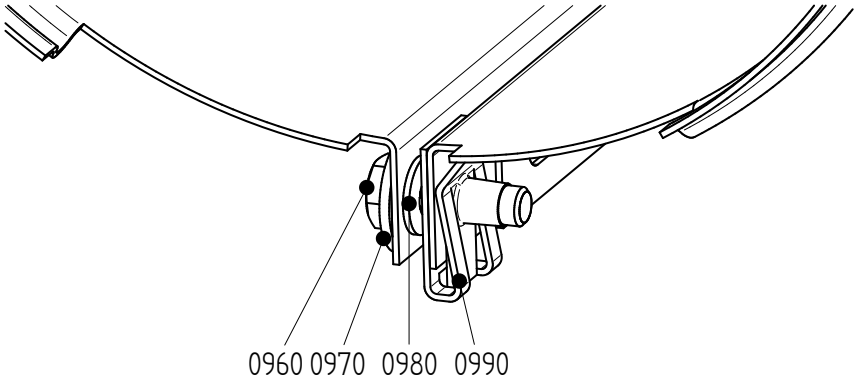

Figure 10: Fitting jacket.

4 Fit the jacket (0270) at pump side. Place it over the present jacket at motor side. The annular groove must be located at pump side.

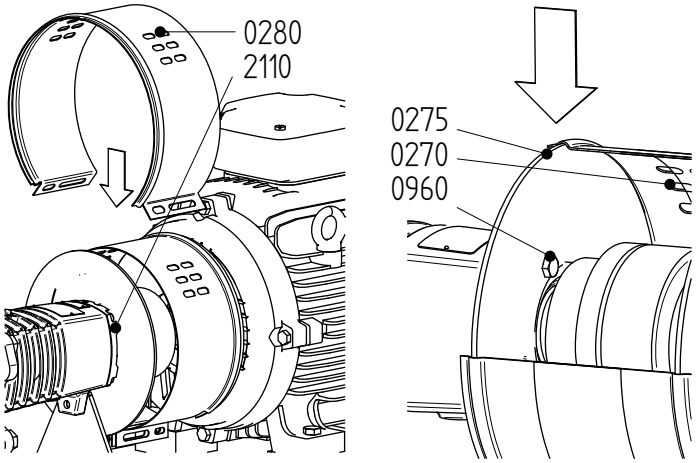

Figure 11: Fitting the jacket at pump side.

5 Close the jacket and fit a bolt (0230) and fit bolt (0960). See figure 10.

6 Slide the jacket at motor side towards the motor as far as possible. Fix both jackets with bolt (0960).

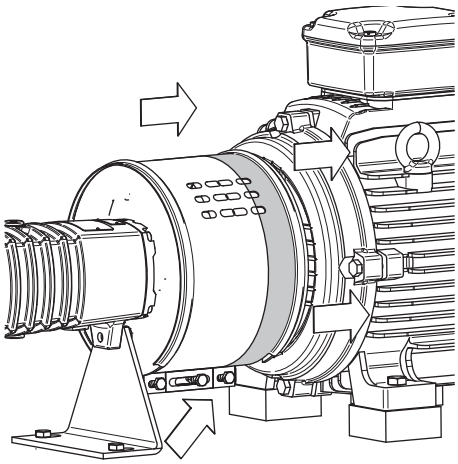

Figure 12: Adjusting the jacket at motor side.

7.5 Replacing the impeller and the wear ring

The play between the impeller and the wear ring is 0,3 mm to the diameter at delivery. In case the play has increased to 0,5-0,7 mm due to wear, the impeller and the wear ring should be replaced.

7.5.1 Disassembling the impeller

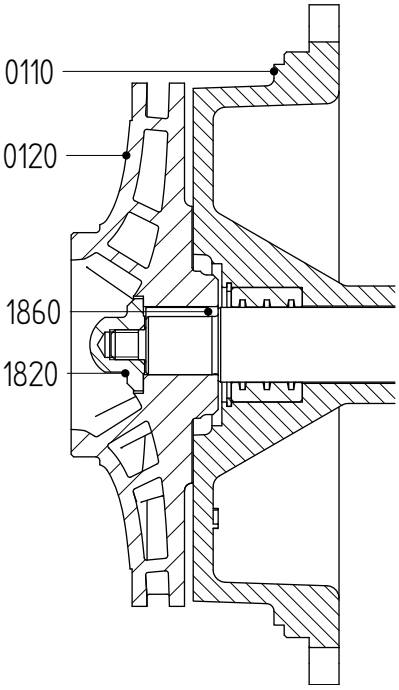

Figure 13: Disassembling the impeller.

The item numbers used are referring to figure 13.

1 Remove the Back-Pull-Out unit, see paragraph 7.4.2 "Disassembling the Back-Pull-Out unit".

2 Remove the cap nut (1820).

3 Remove the impeller (0120) with a pulley puller, or wrest the impeller by inserting for instance 2 big screwdrivers between the impeller and the pump cover (0110).

4 Remove the impeller key (1860).

7.5.2 Mounting the impeller

1 Place the impeller key (1860) in the key way of the pump shaft.

2 Push the impeller onto the pump shaft.

3 Fit the cap nut. For tightening moment of the cap nut see paragraph 10.1.2 "Tightening moments for cap nut".

7.5.3 Disassembling the wear ring

After removing the Back-Pull-Out unit the wear ring can be removed. In most cases the ring has been fixed so tightly that it cannot be removed undamaged.

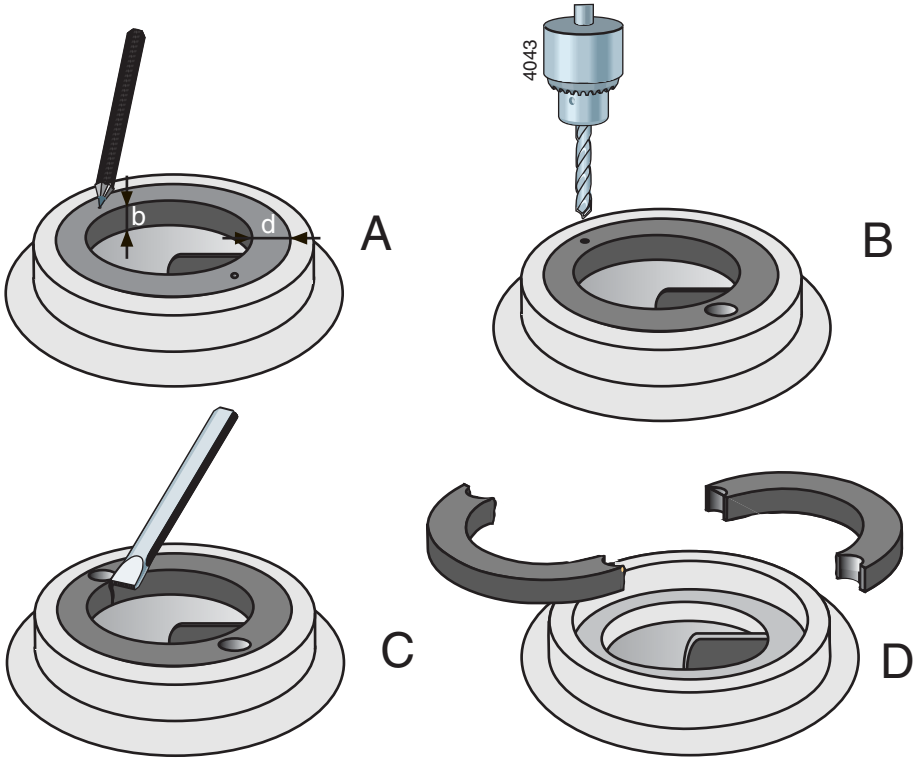

Figure 14: Removal of wear ring.

1 Measure the thickness (d) and the width (b) of the ring, see figure 14 A.

2 Make a centre hole in the middle of the edge of the ring at two opposite points, see figure 14 B.

3 Use a drill with a diameter just a little bit smaller than the thickness (d) of the ring and drill two holes in the ring, see figure 14 C. Don't drill deeper than the width (b) of the ring. Take care not to damage the fitting edge of the pump casing.

4 Use a chisel to cut the remaining part of the ring thickness. Now you can remove the ring in two parts from the pump casing, see figure 14 D.

5 Clean the pump casing and carefully remove all bore dust and metal splinters.

7.5.4 Assembling the wear ring

1 Clean and degrease the fitting edge of the pump casing where the wear ring is to be mounted.

2 Degrease the outer edge of the wear ring and put a few drops of Loctite 641 on it.

3 Fit the wear ring in the pump casing. **Take care it is not pushed out of alignment!**

7.6 Bearings L1, L2 and mechanical seal M1, M5

7.6.1 Instructions for disassembly of bearings

➢ *First read the following instructions regarding disassembly. Follow these instructions closely when disassembling bearings.*

- Use **a proper puller** to remove the bearings from the pump shaft.
- If no proper puller is available, carefully knock at the inner raceway of the bearing. Use an ordinary hammer and a mild steel drift for this.
  Never knock at the bearing with a hammer!

7.6.2 Disassembling bearing L1 and mechanical seal M1, M5

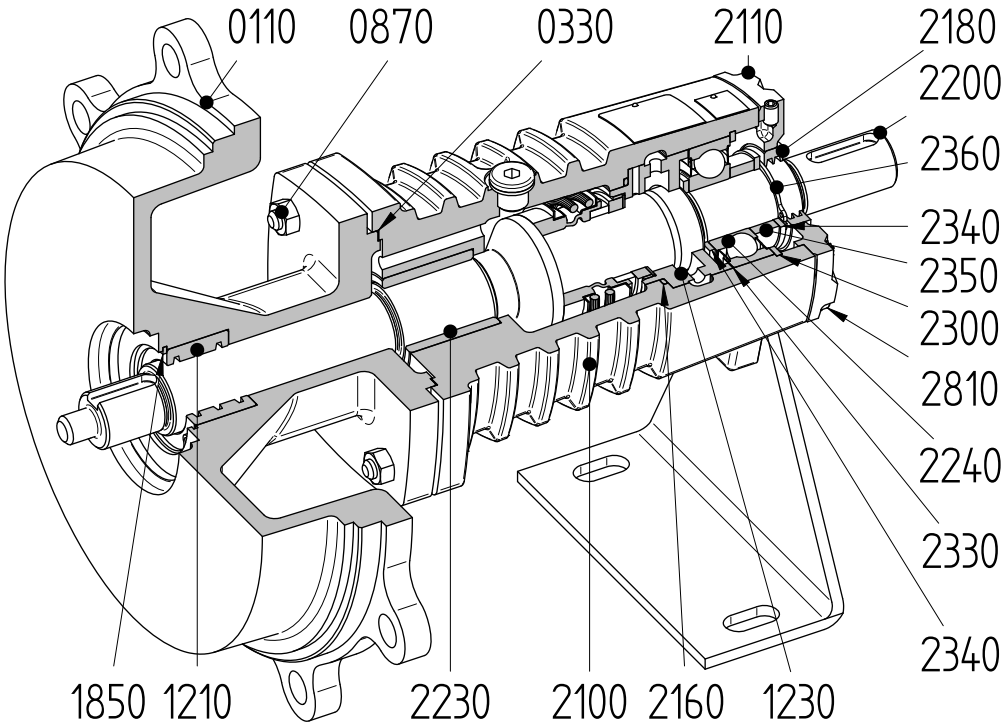

Figure 15: Bearing L1 and mechanical seal M1, M5).

1 Dismantle the impeller, see chapter 7.5.1 "Disassembling the impeller".
2 Unscrew the nuts (0870).
3 Mark the position of the pump cover (0110) in relation to the bearing bracket (2100). Knock the pump cover loose and remove it.
4 Unscrew the Allen screws (2810) and remove the bearing cover (2110).
5 Check to ensure that the oil catcher (2180) are undamaged. Replace them if necessary.
6 Remove the inner circlip (2300).
7 Press at the pump shaft (2200) at the impeller side to loosen the bearing (2240) from the bearing bracket (2100). Subsequently remove the pump shaft with the bearing from the bearing bracket.
8 Remove the outer circlip (2360), the adjusting ring (2340) and the spacer sleeve (2350).
9 Remove the bearing (2240) from the pump shaft.
10 Remove the adjusting rings (2330) (2340) and the shaft seal housing (1230).

11 Remove the O-ring (2160).

12 Push the counter-ring of the mechanical seal out of the shaft seal housing.

13 Loosen the set screw (n.a. for bellows seal) and remove the rotating part of the mechanical seal from the pump shaft.

7.6.3 Disassembling bearing L2 and mechanical seal M1, M5

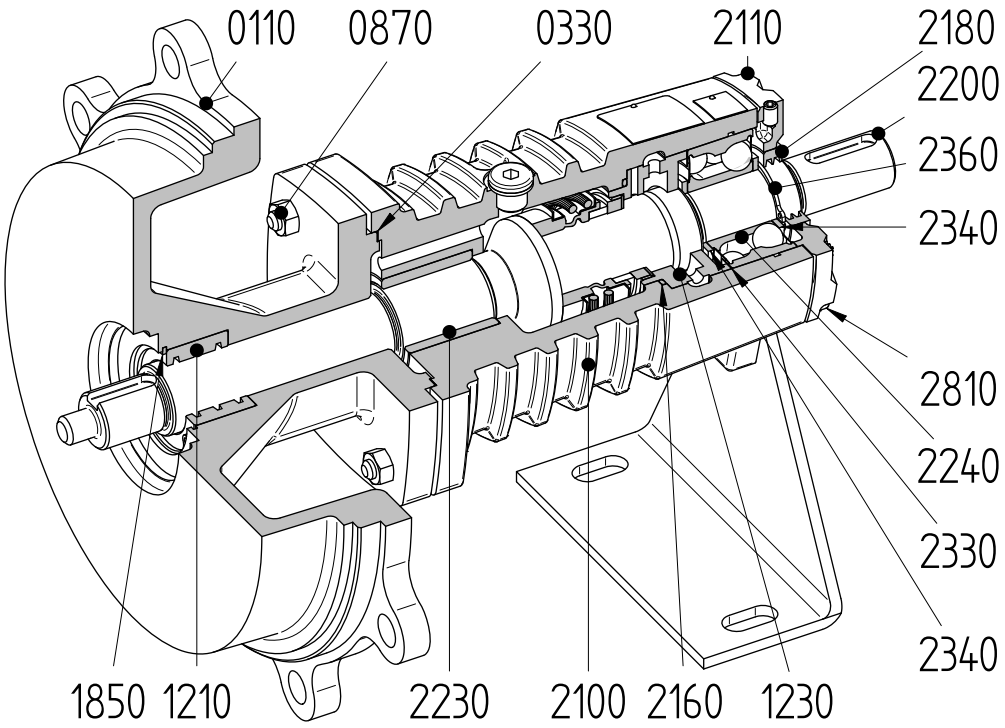

Figure 16: Bearing L2 and mechanical seal M1, M5).

1 Dismantle the impeller, see chapter 7.5.1 "Disassembling the impeller".

2 Unscrew the nuts (0870).

3 Mark the position of the pump cover (0110) in relation to the bearing bracket (2100). Knock the pump cover loose and remove it.

4 Unscrew the Allen screws (2810) and remove the bearing cover (2110).

5 Check to ensure that the oil catcher (2180) are undamaged. Replace them if necessary.

6 Press at the pump shaft (2200) at the impeller side to loosen the bearing (2240) from the bearing bracket (2100). Subsequently remove the pump shaft with the bearing from the bearing bracket.

7 Remove the outer circlip (2360) and the adjusting ring (2340).

8 Remove the bearing from the pump shaft.

9 Remove the adjusting rings (2330) (2340) and the shaft seal housing (1230).

10 Remove the O-ring (2160).

11 Push the counter-ring of the mechanical seal out of the shaft seal housing.

12 Loosen the set screw (n.a. for bellows seal) and remove the rotating part of the mechanical seal from the pump shaft.

7.6.4 Instructions for mounting a mechanical seal

➢ *First read the following instructions regarding the mounting of a mechanical seal. Follow these instructions closely when mounting a mechanical seal.*

- **Leave the assembly of a mechanical seal with PTFE (Teflon) covered O-rings to a specialist.** These rings are easily damaged during assembly.
- A mechanical seal is a fragile precision instrument. Leave the seal in its original packing until you are ready to fit it!
- Clean all receiving parts properly. Make sure your hands and working environment are clean!
- **Never touch the sliding surfaces with ones fingers!**
- Take care not to damage the seal during assembly. Never put the rings down on their sliding surfaces!

7.6.5 Instructions for assembly of bearings

➢ *First read the following instructions regarding assembly. Follow these instructions closely when assembling bearings.*

- Make sure your working place is clean.
- Leave the bearings in their original packing as long as possible.
- Make sure the pump shaft and the bearing seats do have a smooth surface, free of burrs.
- Slightly oil the pump shaft and the other relevant parts before assembly.
- **Preheat the bearings to 110°C** before mounting them on the pump shaft.
- If preheating is not possible: knock the bearing onto the pump shaft. **Never knock at the bearing directly!** Use a mounting bush positioned against the inner raceway of the bearing and a normal hammer (a soft hammer might loose some splinters which could damage the bearing).

7.6.6 Assembling bearing L1 and mechanical seal M1, M5

1 Clean the interior of the bearing bracket properly.

2 Check inside diameter bearing bush (2230). Replace them if necessary.

Table 6: Check bearing bush.

Bearing group	Maximum inside diameter
1	35,15
2	45,15

3 Put the shaft seal housing flat down and press the counter-ring of the seal straight into it. The notch in the counter ring must correspond to the locking pin (1270) (n.a. for bellows seal), else the counter ring will break! If necessary, use a plastic pressure piece. **Never hammer it inside!** The maximum axial turn of the counter-ring is 0,1 mm.

4 Fit new O-ring (2160).

5 Push the rotating part of the seal onto the pump shaft. **Put some glycerine or silicon spray on the O-ring or the bellows to facilitate the assembly.** Fix the mechanical seal with the set screw (n.a. for bellows seal).

6 Fit the shaft seal housing (1230) and the adjusting rings (2330) (2340) on the pump shaft (2200).

7 Preheat the bearing (2240) and fit them on the pump shaft. Make sure they are positioned straight on the pump shaft and push them firmly against the shaft shoulder and against the adjusting ring (2340). **Let the bearings cool down!**

8 Place the spacer sleeve (2350) and adjusting ring (2340) and fit the outer circlip (2360).

9 Fit the pump shaft with bearings, starting from the motor side, in the bearing bracket. Knock at the shaft end at the coupling side until the shaft seal housing (1230) the bearing bracket (2100) touches. After each knock rotate the pump shaft one turn to prevent bearing damage. **The pump shaft with the bearing should go into the bearing bracket straight!**

10 Fit the inner circlip (2300).

11 Fit the bearing covers (2110) and fix them with Allen screws (2810).

12 Ensure the throttling bush (1210) is undamaged. Replace if necessary.

13 Fit a new gasket (0330) into the bearing bracket and fit the pump cover back into the bearing bracket.

14 Fit the nuts (0870) and tighten them crosswise with the proper tightening torque. See paragraph 10.1 "Tightening moments".

15 Fit the impeller and other parts, see paragraph 7.5.2 "Mounting the impeller".

7.6.7 Assembling bearing L2 and mechanical seal M1, M5

1 Clean the interior of the bearing bracket properly.

2 Check inside diameter bearing bush (2230). Replace them if necessary.

Table 7: Check bearing bush.

Bearing group	Maximum inside diameter
1	35,15
2	45,15

3 Put the shaft seal housing flat down and press the counter-ring of the seal straight into it. The notch in the counter ring must correspond to the locking pin (1270) (n.a. for bellows seal), else the counter ring will break! If necessary, use a plastic pressure piece. **Never hammer it inside!** The maximum axial turn of the counter-ring is 0,1 mm.

4 Fit new O-ring (2160).

5 Push the rotating part of the seal onto the pump shaft. **Put some glycerine or silicon spray on the O-ring or the bellows to facilitate the assembly.** Fix the mechanical seal with the set screw (n.a. for bellows seal).

6 Fit the shaft seal housing (1230) and the adjusting rings (2330) (2340) on the pump shaft (2200).

7 Preheat the bearing (2240) and fit them on the pump shaft. Make sure they are positioned straight on the pump shaft and push them firmly against the shaft shoulder and against the adjusting ring (2340). **Let the bearings cool down!**

8 Place the adjusting ring (2340) and fit the outer circlip (2360).

9 Fit the pump shaft with bearings, starting from the motor side, in the bearing bracket. Knock at the shaft end at the coupling side until the shaft seal housing (1230) the bearing bracket (2100) touches. After each knock rotate the pump shaft one turn to prevent bearing damage. **The pump shaft with the bearing should go into the bearing bracket straight!**

10 Fit the bearing covers (2110) and fix them with Allen screws (2810).

11 EFit a new gasket (0330) into the bearing bracket and fit the pump cover back into the bearing bracket.

12 Fit the nuts (0870) and tighten them crosswise with the proper tightening torque. See paragraph 10.1 "Tightening moments".

13 Fit the impeller and other parts, see paragraph 7.5.2 "Mounting the impeller".

8 Dimensions

8.1 Base plate dimensions and weights

base plate number	[mm]									Weight [kg]
	L	B	fa	fb	fc	fd	fe	ff	fh	
1	800	305	19	6	385	433	120	560	45	20
2	1000	335	19	8	425	473	145	710	63	38
3	1250	375	24	10	485	545	175	900	80	69
4	1250	500	24	10	610	678	175	900	90	79
5	1600	480	24	10	590	658	240	1120	100	107
6	1650	600	24	10	720	788	240	1170	130	129
12	1600	710	28	-	790	850	310	1 x 1000	130	218

8.2 Connections

Table 8: Connections to the pump.

BL	Leakage drain	G ¼
BP	Pump casing drain	G ½
BS	Bearing bracket drain	G ¼
BV	Oil filling plug	G ¼
BZ	Connection discharge flange	G ½

8.3 Pump dimensions

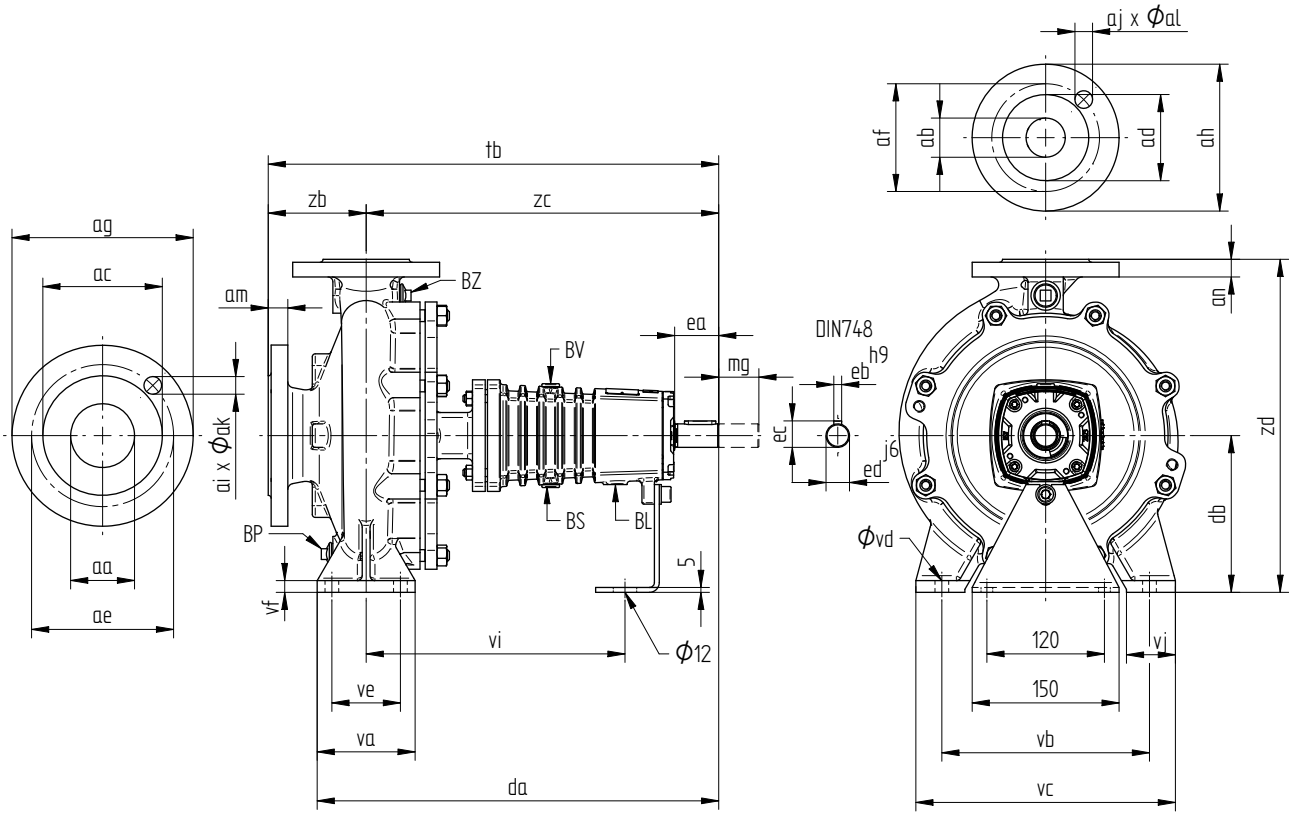

Figure 17: Pump dimensions.

ISO 7005 PN16											
aa	**ab**	**ac**	**ad**	**ae**	**af**	**ag**	**ah**	**ai x ak**	**aj x al**	**am**	**an**
50	32	102	78	125	100	165	140	4 x 18	4 x 18	20	18
65	40	122	88	145	110	185	150	4 x 18	4 x 18	20	18
65	50	122	102	145	125	185	165	4 x 18	4 x 18	20	20
80	65	138	122	160	145	200	185	8 x 18	4 x 18	22	20
100	80	158	138	180	160	220	200	8 x 18	8 x 18	22	22
125	100	188	158	210	180	250	220	8 x 18	8 x 18	24	22
150	125	212	188	240	210	285	250	8 x 23	8 x 18	24	24

ISO 7005 ≅ EN 1092-2

CT	aa	ab	da	db	ea	eb	ec	ed	mg	tb	va	vb	vc	vd	ve	vf	vi	vj	zb	zc	zd	[kg]
32(C)-160	50	32	410	132	45	8	27	24	100	440	100	190	240	14	70	12	268	50	80	360	292	35
32(C)-200	50	32	410	160	45	8	27	24	100	440	100	190	240	14	70	12	268	50	80	360	340	40
32-250	50	32	423	180	45	8	27	24	100	460	125	250	320	14	95	14	268	65	100	360	405	61
40C-160	65	40	410	132	45	8	27	24	100	440	100	190	240	14	70	12	268	50	80	360	292	37
40C-200	65	40	410	160	45	8	27	24	100	460	100	212	265	14	70	12	268	50	100	360	340	44
40-250	65	40	423	180	45	8	27	24	100	460	125	250	320	14	95	14	268	65	100	360	405	53
50C-160	65	50	410	160	45	8	27	24	100	460	100	212	265	14	70	12	268	50	100	360	340	40
50C-200	65	50	410	160	45	8	27	24	100	460	100	212	265	14	70	12	268	50	100	360	360	45
50C-250	65	50	423	180	45	8	27	24	100	460	125	250	320	14	95	14	268	65	100	360	405	56
65C-160	80	65	423	160	45	8	27	24	100	460	125	212	280	14	95	12	268	65	100	360	360	45
65C-200	80	65	423	180	45	8	27	24	140	460	125	250	320	14	95	14	268	65	100	360	405	52

CT	aa	ab	da	db	ea	eb	ec	ed	mg	tb	va	vb	vc	vd	ve	vf	vi	vj	zb	zc	zd	[kg]
65A-250	80	65	550	200	75	10	35	32	140	570	160	280	360	18	120	14	346	80	100	470	450	80
80C-160	100	80	423	180	45	8	27	24	140	485	125	250	320	14	95	14	268	65	125	360	405	53
80C-200	100	80	533	180	75	10	35	32	140	595	125	280	345	14	95	14	346	65	125	470	430	72
80C-250	100	80	550	200	75	10	35	32	140	595	160	315	400	18	120	15	346	80	125	470	480	86
100-160	125	100	550	200	75	10	35	32	100	595	160	280	360	18	120	15	346	80	125	470	515	88
100C-200	125	100	550	200	75	10	35	32	140	595	160	280	360	18	120	15	346	80	125	470	480	99
100C-250	125	100	550	225	75	10	35	32	140	610	160	315	400	18	120	16	346	80	140	470	505	97
125-250	150	125	550	250	75	10	35	32	140	610	160	315	400	18	120	18	346	80	140	470	605	123

8.4 Pump-motor unit with standard coupling

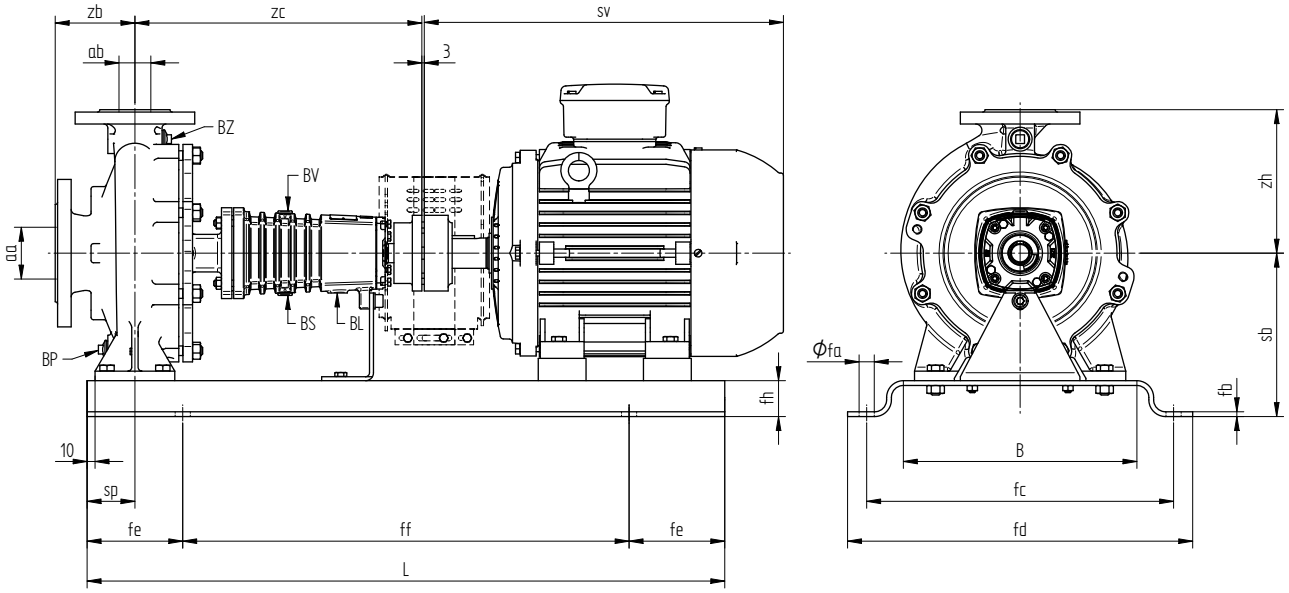

Figure 18: Pump-motor unit with standard coupling.

Type CT								IEC Motor																		
								71	80	90	90	100	112	132	132	160	160	180	180	200	225	225	250	280	280	315
										S	L	L	M	S	M	M	L	M	L	L	S	M	M	S	M	S
	aa	ab	sp	zb	zc	zh	sv(*)	254	296	336	348	402	432	486	520	652	672	712	742	790	904	904	1014	1124	1176	1144
32(C)-160	50	32	60	80	360	160	sb	177	177	177	177	177	177	177												
							x	1	1	1	1	1	1	1												
32(C)-200	50	32	60	80	360	180	sb	205	205	205	205	205	205	205		223										
							x	1	1	1	1	1	1	1		2										
32-250	50	32	72	100	360	225	sb		243	243	243	243	243	243		243	243									
							x		2	2	2	2	2	2		2	2									
40C-160	65	40	60	80	360	160	sb	177	177	177	177	177	177	177		223										
							x	1	1	1	1	1	1	1		2										
40C-200	65	40	60	100	360	180	sb		205	205	205	205	205	205		223										
							x		1	1	1	1	1	1		2										
40-250	65	40	72	100	360	225	sb		243	243	243	243	243	243		243	243	260								
							x		2	2	2	2	2	2		2	2	3								
50C-160	65	50	60	100	360	180	sb	205	205	205	205	205	205	205		223										
							x	1	1	1	1	1	1	1		2										
50C-200	65	50	60	100	360	200	sb		205	205	205	205	205	205		223	223	260		290						
							x		1	1	1	1	1	1		2	2	3		4						
50C-250	65	50	72	100	360	225	sb		243	243	243	243	243	243		243	243	260		290						
							x		2	2	2	2	2	2		2	2	3		4						
65C-160	80	65	72	100	360	200	sb		205	205	205	205	205	205		223	223	260		290						
							x		1	1	1	1	1	1		2	2	3		4						
65C-200	80	65	72	100	360	225	sb		243	243	243	243	243	243		243	243	260		290						
							x		2	2	2	2	2	2		2	2	3		4						
65A-250	80	65	90	100	470	250	sb			280	280	280	280	280	280	280	280	280	280	290		315				
							x			3	3	3	3	3	3	3	3	3	3	4		4				

Type CT								IEC Motor																		
								71	80	90	90	100	112	132	132	160	160	180	180	200	225	225	250	280	280	315
										S	L	L	M	S	M	M	L	M	L	L	S	M	M	S	M	S
	aa	ab	sp	zb	zc	zh	sv(*)	254	296	336	348	402	432	486	520	652	672	712	742	790	904	904	1014	1124	1176	1144
80C-160	100	80	72	125	360	225	sb			243	243	243	243	243		243	243	260		290						
							x			2	2	2	2	2		2	2	3		4						
80C-200	100	80	72	125	470	250	sb			260	260	260	260	260	260	260	260	260		290		315	380	410		
							x			3	3	3	3	3	3	3	3	3		4		4	6	6		
80C-250	100	80	72	125	470	280	sb			290	290	290	290	290	290	290	290	290		290		315	380	410		
							x			4	4	4	4	4	4	4	4	4		4		4	6	6		
100-160	125	100	90	125	470	315	sb				280	280	280	280		280	280	280		290						
							x				3	3	3	3		3	3	3		4						
100C-200	125	100	90	125	470	280	sb					280	280	280	280	280	280	280		290		315	380	410		
							x					3	3	3	3	3	3	3		4		4	6	6		
100C-250	125	100	90	140	470	280	sb					315	315	315	315	315	315	315		315		315	380	410	410	445
							x					4	4	4	4	4	4	4		4		4	6	6	6	12
125-250	150	125	90	140	470	355	SB					340	340	340	340	340	340	340	340	340						
							X					4	4	4	4	4	4	4	4	4						

x = base plate number

(*) Motor length based on DIN 42673, could be different due to applied motor make

8.5 Pump-motor unit with spacer coupling

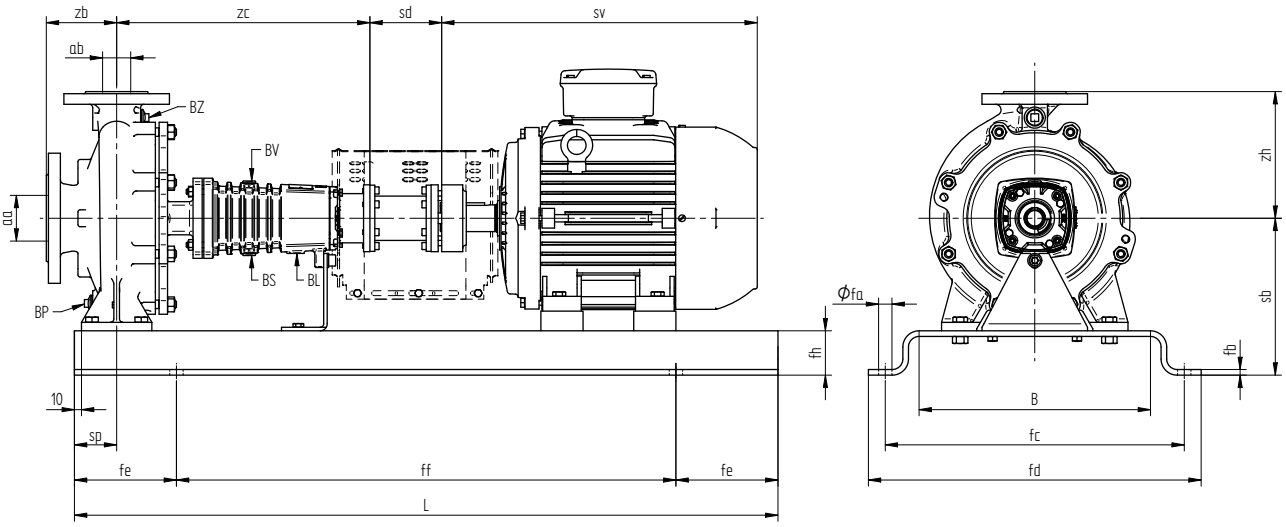

Figure 19: Pump-motor unit with spacer coupling.

Type CT									IEC Motor																		
									71	80	90	90	100	112	132	132	160	160	180	180	200	225	225	250	280	280	315
											S	L	L	M	S	M	M	L	M	L	L	S	M	M	S	M	S
	aa	ab	sd	sp	zb	zc	zh	sv(*)	254	296	336	348	402	432	486	520	652	672	712	742	790	904	904	1014	1124	1176	1144
32(C)-160	50	32	100	60	80	360	160	sb	177	177	177	177	195	195	195												
								x	1	1	1	1	2	2	2												
32(C)-200	50	32	100	60	80	360	180	sb	205	205	205	205	223	223	223		223										
								x	1	1	1	1	2	2	2		2										
32-250	50	32	100	72	100	360	225	sb		243	243	243	243	2432	243		260	260									
								x		2	2	2	2		2		3	3									
40C-160	65	40	100	60	80	360	160	sb	177	177	177	177	195	195	195		223										
								x	1	1	1	1	2	2	2		2										
40C-200	65	40	100	60	100	360	180	sb		205	205	205	223	223	223		223										
								x		1	1	1	2	2	2		2										
40-250	65	40	100	72	100	360	225	sb		243	243	243	243	243	243		260	260	260								
								x		2	2	2	2	2	2		3	3	3								
50C-160	65	50	100	60	100	360	180	sb	205	205	205	205	223	223	223		223										
								x	1	1	1	1	2	2	2		2										
50C-200	65	50	100	60	100	360	200	sb		205	205	205	223	223	223		223	240	260		290						
								x		1	1	1	2	2	2		2	3	3		4						
50C-250	65	50	100	72	100	360	225	sb		243	243	243	243	243	243		260	260	260		290						
								x		2	2	2	2	2	2		3	3	3		4						
65C-160	80	65	100	72	100	360	200	sb		205	205	223	223	223	223		240	240	260		290						
								x		1	1	2	2	2	2		3	3	3		4						
65C-200	80	65	140	72	100	360	225	sb		243	243	243	243	243	243		260	260	260		290						
								x		2	2	2	2	2	2		3	3	3		4						
65A-250	80	65	140	90	100	470	250	sb			280	280	280	280	280	280	280	280	280	280	300		325				
								x			3	3	3	3	3	3	3	3	3	5	5		5				
80C-160	100	80	140	72	125	360	225	sb				243	243	243	243	243		260	260	260		290						
								x				2	2	2	2	2		3	3	3		4						

Type CT									IEC Motor																			
									71	80	90	90	100	112	132	132	160	160	180	180	200	225	225	250	280	280	315
											S	L	L	M	S	M	M	L	M	L	L	S	M	M	S	M	S
	aa	ab	sd	sp	zb	zc	zh	sv(*)	254	296	336	348	402	432	486	520	652	672	712	742	790	904	904	1014	1124	1176	1144
80C-200	100	80	140	72	125	470	250	sb				260	260	260	260	260	260	260	260	260		300		325	380	410	
								x				3	3	3	3	3	3	3	3	3		5		5	6	6	
80C-250	100	80	140	72	125	470	280	sb				290	290	290	290	290	290	290	290	290		300		325	350	410	
								x				4	4	4	4	4	4	4	4	4		5		5	6	6	
100-160	125	100	100	90	125	470	315	sb				280	280	280	280		280	280	280		300						
								x				3	3	3	3		3	3	3		5						
100C-200	125	100	140	90	125	470	280	sb					280	280	280	280	280	280	280		300		325	380	410		
								x					3	3	3	3	3	3	3		5		5	6	6		
100C-250	125	100	140	90	140	470	280	sb					315	315	315	315	315	315	315		325		325	380	410	410	475
								x					4	4	4	4	4	4	4		5		5	6	6	6	14
125-250	150	125	140	90	140	470	355	sb					340	340	340	340	340	340	340	350	350						
								x					4	4	4	4	4	4	4	5	5						

x = base plate number

(*) Motor length based on DIN 42673, could be different due to applied motor make

9 Parts

9.1 Ordering parts

9.1.1 Order form

You can use the order form included in this manual for ordering parts.

When ordering parts always quote the following data:

1 Your **address**.

2 The **quantity, the item number and the description** of the part.

3 The **pump number**. The pump number is stated on the label on the cover of this manual and on the type plate of the pump.

4 In the event of different electric motor voltage you should state the correct voltage.

9.1.2 Recommended spare parts

Parts marked with a * are recommended spare parts.

9.2 Pump L1

9.2.1 Sectional drawing L1

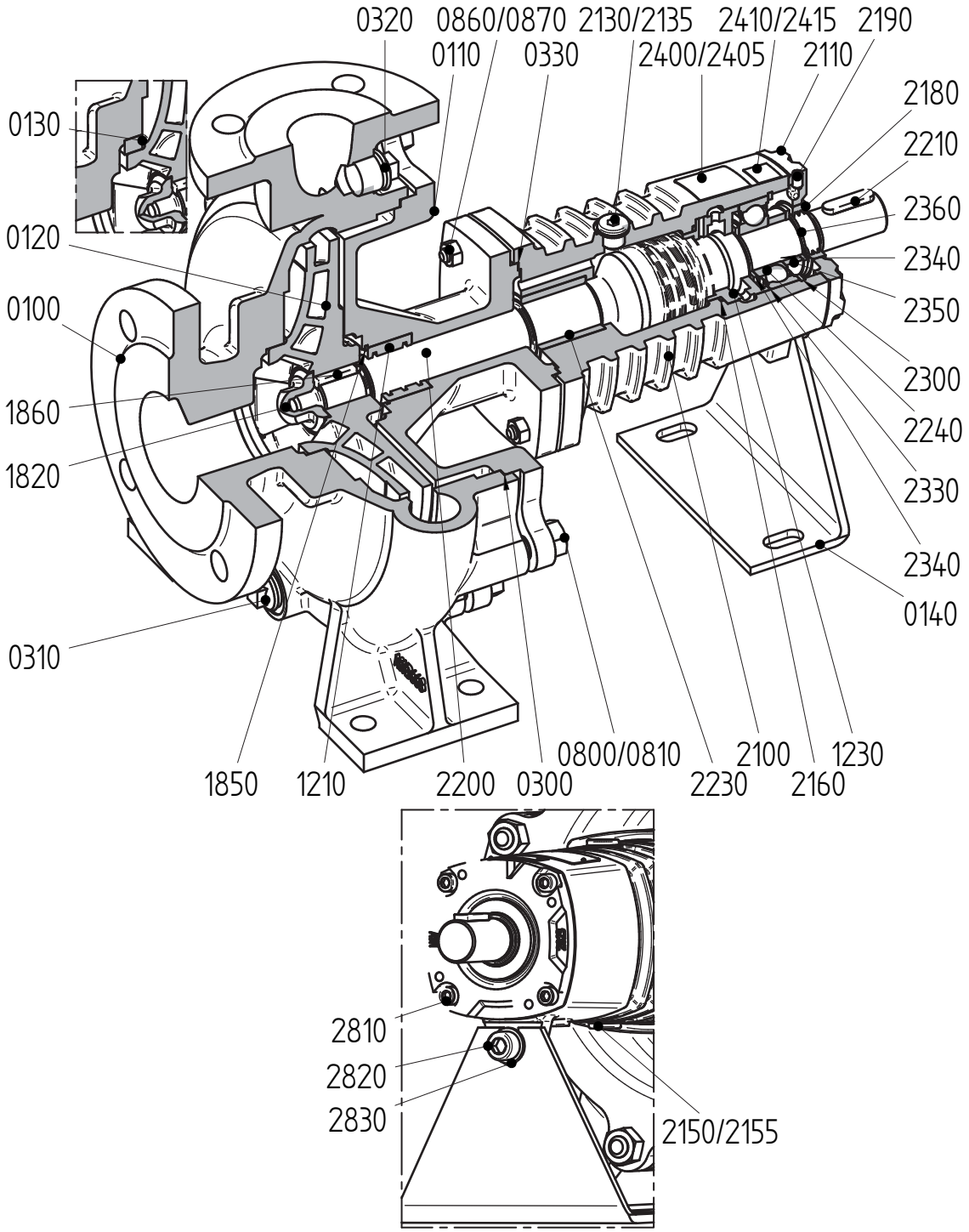

Figure 20: Sectional drawing L1.

9.2.2 Parts list L1

Item	Quantity	Description	Material	
			NG1	NG6
0100	1	pump casing	nodular cast iron	nodular cast iron
0110	1	pump cover	nodular cast iron	
0120*	1	impeller	cast iron	stainless steel
0130*	1	wear ring	cast iron	stainless steel
0140	1	bracket support	steel	
0300*	1	gasket	graphite	
0310	1	plug	cast iron	
0320	1	plug	cast iron	
0330*	1	gasket	graphite	
0800	8/12 (*)	stud	stainless steel	
0810	8/12 (*)	nut	stainless steel	
0860	4	stud	stainless steel	
0870	4	nut	stainless steel	
1210*	1	throttling bush	cast iron	
1230	1	shaft seal housing	stainless steel	
1820*	1	cap nut	stainless steel	
1850*	1	inner circlip	spring steel	
1860*	1	key	stainless steel	
2100	1	bearing bracket	nodular cast iron	
2110	1	bearing cover	cast iron	
2130	1	plug	steel	
2135	1	sealing ring	copper	
2150	1	plug	steel	
2155	1	sealing ring	copper	
2160*	1	O-ring	EPDM / VITON®	
2180*	1	Oil catcher	bronze	
2190	1	set screw	stainless steel	
2200*	1	pump shaft	stainless steel	
2210*	1	coupling key	steel	
2230*	1	bearing bush	Carbon	
2240*	1	ball bearing	- -	
2300*	1	inner circlip	spring steel	
2330	1	adjusting ring	steel	
2340	2	adjusting ring	steel	
2350	1	spacer sleeve	steel	
2360*	1	outer circlip	spring steel	
2400	1	name plate	stainless steel	
2405	2	rivet	stainless steel	
2410	1	arrow plate	aluminium	
2415	2	rivet	stainless steel	
2810	4	Allen screw	steel	
2820	1	Allen screw	steel	
2830	1	washer	steel	

Item 0130: not for the pump types of bearing bracket 1, except 32-250 / 50C-200.

(*) Quantity depends on pump type.

9.3 Pump L2

9.3.1 Sectional drawing L2

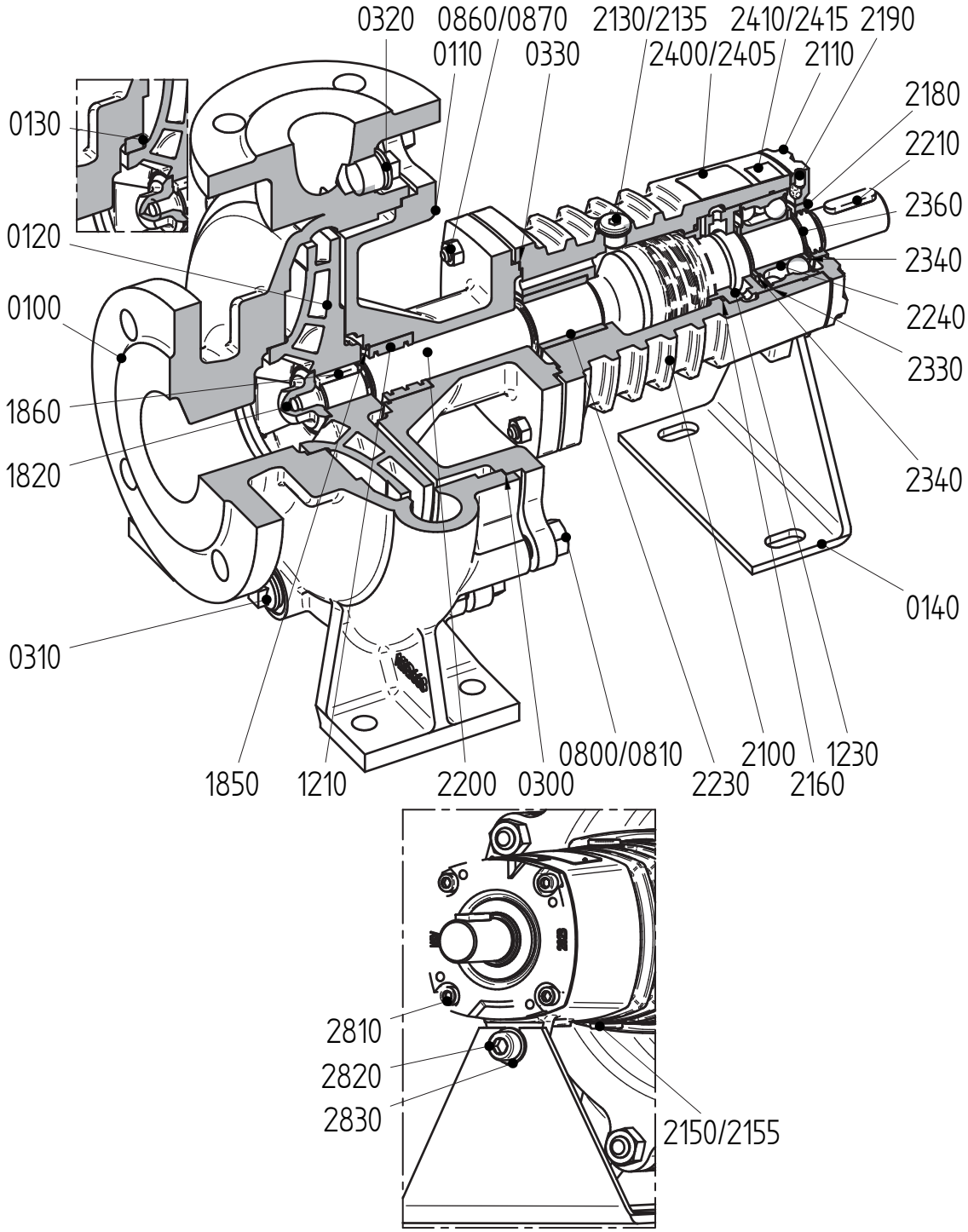

Figure 21: Sectional drawing L2.

9.3.2 Parts list L2

Item	Quantity	Description	Material	
			NG1	NG6
0100	1	pump casing	nodular cast iron	nodular cast iron
0110	1	pump cover	nodular cast iron	
0120*	1	impeller	cast iron	stainless steel
0130*	1	wear ring	cast iron	stainless steel
0140	1	bracket support	steel	
0300*	1	gasket	graphite	
0310	1	plug	cast iron	
0320	1	plug	cast iron	
0330*	1	gasket	graphite	
0800	8/12 (*)	stud	stainless steel	
0810	8/12 (*)	nut	stainless steel	
0860	4	stud	stainless steel	
0870	4	nut	stainless steel	
1210*	1	throttling bush	cast iron	
1230	1	shaft seal housing	stainless steel	
1820*	1	cap nut	stainless steel	
1850*	1	inner circlip	spring steel	
1860*	1	key	stainless steel	
2100	1	bearing bracket	nodular cast iron	
2110	1	bearing cover	cast iron	
2130	1	plug	steel	
2135	1	sealing ring	copper	
2150	1	plug	steel	
2155	1	sealing ring	copper	
2160*	1	O-ring	EPDM / VITON®	
2180*	1	Oil catcher	bronze	
2190	1	set screw	stainless steel	
2200*	1	pump shaft	stainless steel	
2210*	1	coupling key	steel	
2230*	1	bearing bush	Carbon	
2240*	1	angular contact ball bearing	- -	
2330	1	adjusting ring	steel	
2340	2	adjusting ring	steel	
2360*	1	outer circlip	spring steel	
2400	1	name plate	stainless steel	
2405	2	rivet	stainless steel	
2410	1	arrow plate	aluminium	
2415	2	rivet	stainless steel	
2810	4	Allen screw	steel	
2820	1	Allen screw	steel	
2830	1	washer	steel	

Item 0130: not for the pump types of bearing bracket 1, except 32-250 / 50C-200.

(*) Quantity depends on pump type.

9.4 Shaft sealing group M1

9.4.1 Mechanical seal MG12-G60

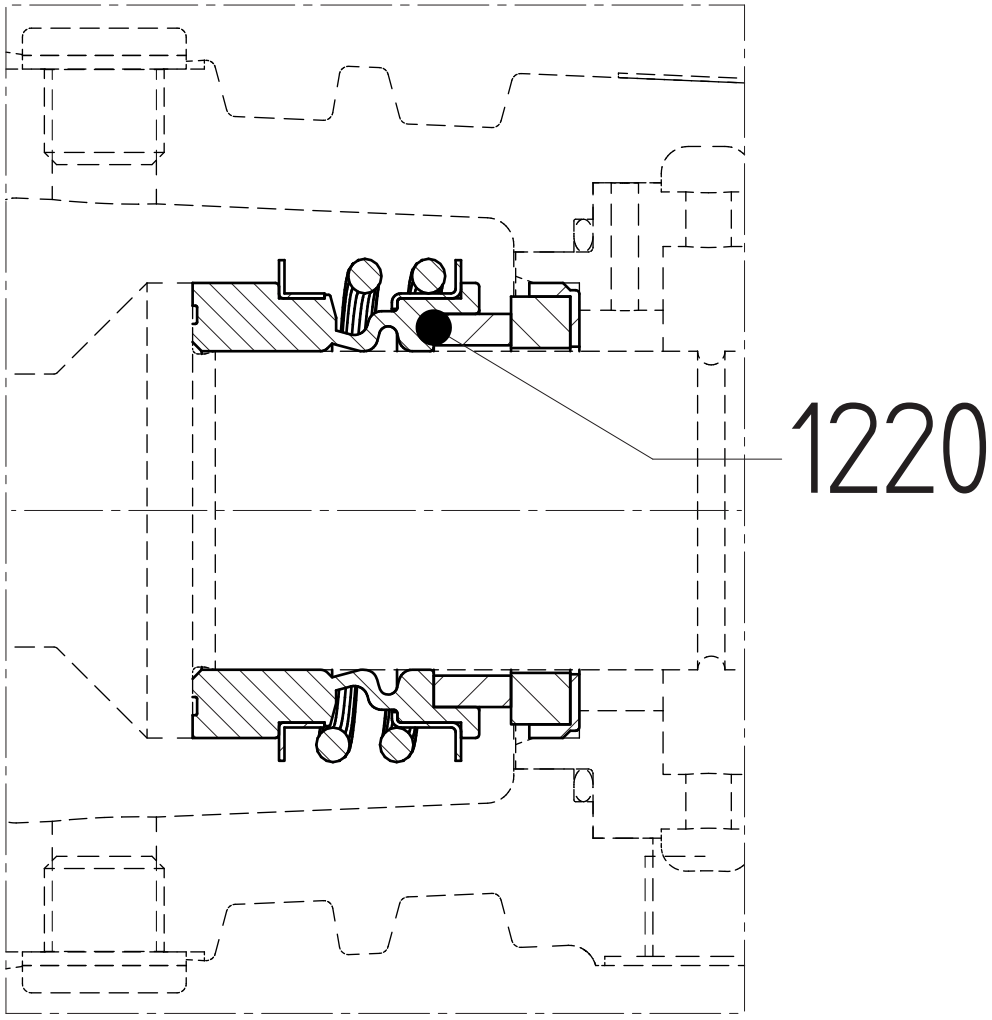

Figure 22: Mechanical seal MG12-G60.

9.4.2 Parts list shaft sealing group M1

Item	Quantity	Description	Material
1220*	1	mechanical seal	-

9.5 Shaft sealing group M5

9.5.1 Mechanical seal HJ92N

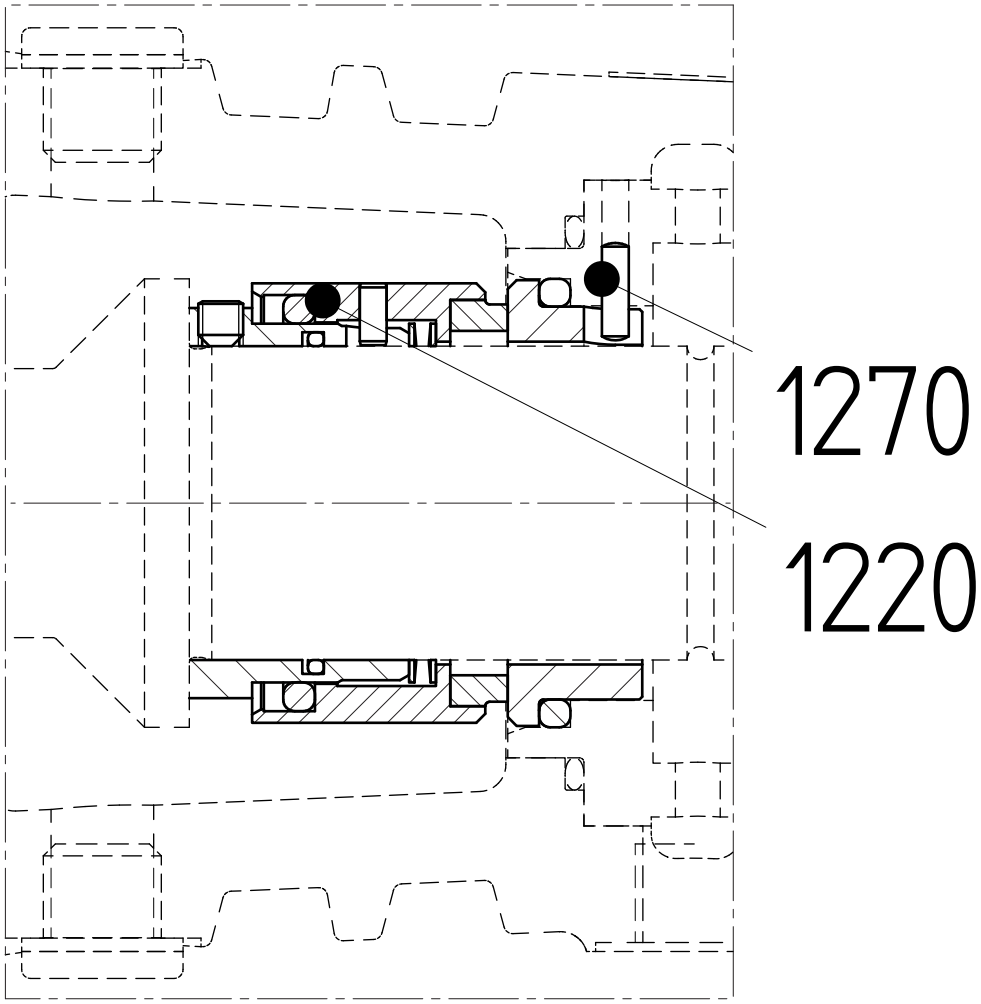

Figure 23: Mechanical seal HJ92N.

9.5.2 Parts list shaft sealing group M5

Item	Quantity	Description	Material
1220*	1	mechanical seal	-
1270	1	locking pin	stainless steel

10 Technical data

10.1 Tightening moments

10.1.1 Tightening moments for bolts and nuts

Table 9: Tightening moments for bolts and nuts.

Materials	8.8	A2, A4
Thread	**Tightening moment [Nm]**	
M6	9	6
M8	20	14
M10	40	25
M12	69	43
M16	168	105
M20	325	180

10.1.2 Tightening moments for cap nut

Table 10: Tightening moments for cap nut (1820).

Size	Tightening moment [Nm]
M12 (bearing group 1)	43
M16 (bearing group 2)	105

10.2 Maximum allowable working pressures

Table 11: Maximum allowable working pressure [kPa] (according to ISO 7005)

Material	Temperature [°C]					
	120	150	200	250	300	350
NG	1600	1550	1470	1390	1280	1120

100 kPa = 1 bar

10.3 Maximum speed

Table 12: Maximum speed.

CT	Maximum speed [min^{-1}]	
	L1	L2
32(C)-160	3600	3600
32(C)-200	3600	3600
32-250	3600	3600
40C-160	3600	3600
40C-200	3600	3600
40-250	3000	3600
50C-160	3600	3600
50C-200	3600	3600
50-250	3600	3600
65C-160	3000	3600
65C-200	3000	3600
65A-250	1800	3000
80C-160	1800	3000
80C-200	3000	3600
80-250	3600	3600
100-160	3600	3600
100C-200	1800	3000
100C-250	1800	3000
125-250	1800	1800

10.4 Temperature dissipation in the pump

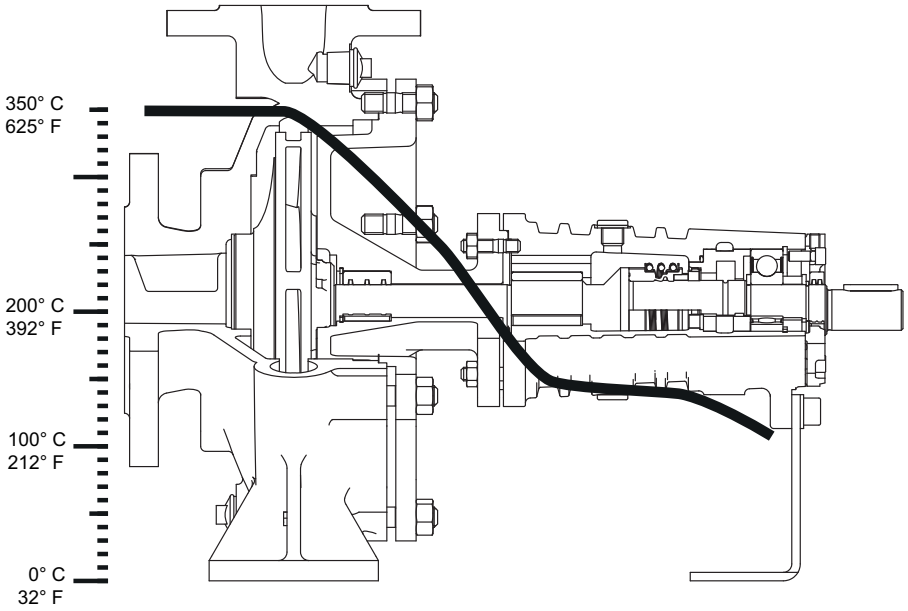

Figure 24: Temperature dissapation in the pump.

10.5 Pressure near the impeller hub

Pressure near the impeller hub above the inlet pressure, calculated for a specific mass of 1000 kg/m^3.

Table 13: Pressure near the impeller hub.

CT	n [min^{-1}]/[bar]									
	900	1200	1500	1800	2100	2400	2700	3000	3300	3600
32(C)-160	0,1	0,2	0,4	0,6	0,8	1,0	1,2	1,5	1,9	2,2
32(C)-200	0,1	0,2	0,4	0,5	0,7	0,9	1,2	1,4	1,7	2,1
32-250	0,2	0,4	0,6	0,8	1,2	1,5	1,9	2,4	2,9	3,4
40C-160	0,1	0,1	0,2	0,3	0,4	0,6	0,7	0,9	1,1	1,3
40C-200	0,2	0,4	0,6	0,9	1,3	1,6	2,1	2,5	3,1	3,7
40-250	0,3	0,4	0,7	1,0	1,4	1,8	2,3	2,8	3,4	3,0
50C-160	0,1	0,2	0,2	0,4	0,5	0,6	0,8	1,0	1,2	1,4
50C-200	0,1	0,2	0,3	0,5	0,6	0,8	1,0	1,3	1,5	1,8
50-250	0,3	0,4	0,7	1,0	1,4	1,8	2,3	2,8		
65C-160	0,0	0,1	0,1	0,1	0,2	0,2	0,3	0,4	0,4	0,5
65C-200	0,1	0,2	0,3	0,5	0,6	0,8	1,0	1,3	1,5	1,8
65A-250	0,2	0,3	0,5	0,7	1,0	1,3	1,6	2,0	2,5	2,9
80C-160	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0		
80C-200	0,0	0,0	0,1	0,1	0,1	0,2	0,2	0,3	0,4	0,4
80-250	0,1	0,3	0,4	0,6	0,8	1,0	1,3	1,6	1,9	2,3
100-160	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
100C-200	0,0	0,1	0,1	0,2	0,2	0,3	0,4	0,4	0,5	0,6
100C-250	0,1	0,1	0,2	0,3	0,4	0,5	0,7	0,8	1,0	1,2
125-250	0,9	1,5	2,4	3,4						

10.6 Permissible forces and moments on the flanges

Forces and moments acting on the pump flanges due to pipe loads can cause misalignment of the pump and driver shafts, deformation and overstressing of the pump casing, or overstressing of the fixing bolts between the pump and the base plate.

The maximum allowable forces and moments on the flanges should be based on the following maximum values for the lateral displacement of the shaft end, relative to the fixed point in space:

- pumps of bearing group 1: 0,15 mm,
- pumps of bearing group 2: 0,20 mm.

The values can be applied simultaneously in all directions with positive or negative signs, or separately on each flange (suction and discharge).

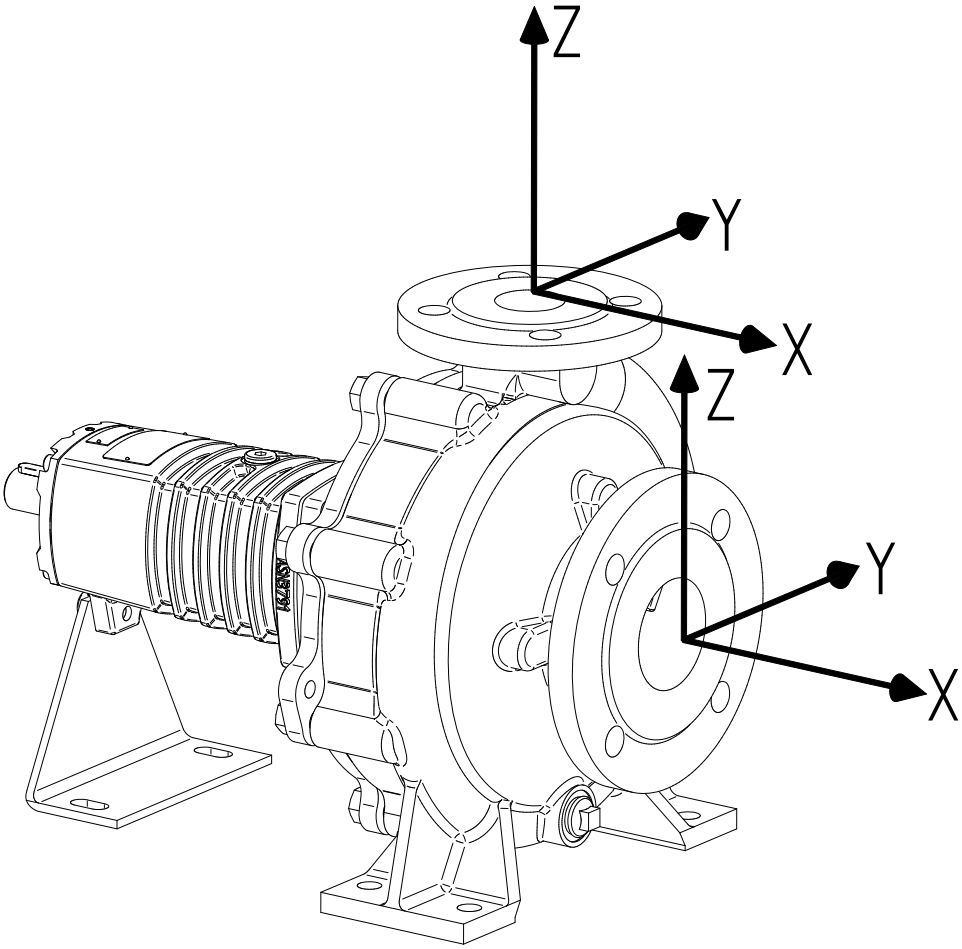

Figure 25: Coordinate system.

Table 14: Permissible forces and moments on the flanges, based on EN-ISO 5199.

CT	Pump unit with a non-grouted base plate															
	Horizontal Pump End branch x-Axis								Horizontal Pump Top branch z-Axis							
	Force [N]				Moment [N.m]				Force [N]				Moment [N.m]			
	F_y	F_z	F_x	ΣF	M_y	M_z	M_x	ΣM	F_y	F_z	F_x	ΣF	M_y	M_z	M_x	ΣM
32(C)-160 32(C)-200 32-250	840	756	924	1456	560	644	784	1148	476	588	504	924	420	476	616	896
40C-160 40C-200 40-250	1036	952	1176	1848	616	672	840	1232	560	700	616	1092	504	588	728	1064
50C-160 50C-200 50-250	1036	952	1176	1848	616	672	840	1232	756	924	840	1456	560	644	784	1148
65C-160 65C-200 65A-250	1260	1148	1400	2212	644	728	896	1316	952	1176	1036	1848	616	672	840	1232
80C-160 80C-200 80-250	1680	1512	1876	2940	700	812	980	1456	1148	1400	1260	2212	644	728	896	1316
100-160 100C-200 100C-250	1988	1792	2212	3472	840	1064	1176	1708	1512	1876	1680	2940	700	812	980	1456
125-250	2520	2268	2800	4396	980	1148	1400	2044	1792	2212	1988	3472	840	1064	1176	1708

The basic values mentioned in the table above are related to the pump casing material nodular cast iron.

10.7 Hydraulic performance

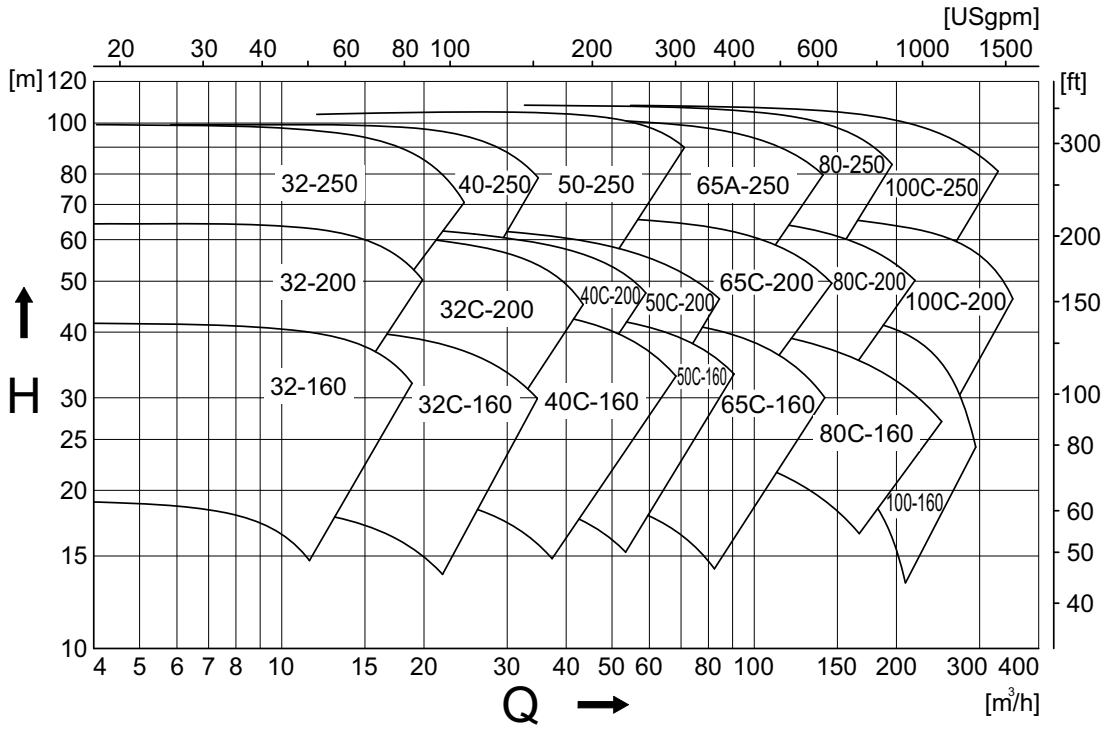

Figure 26: Performance overview 3000 min^{-1}.

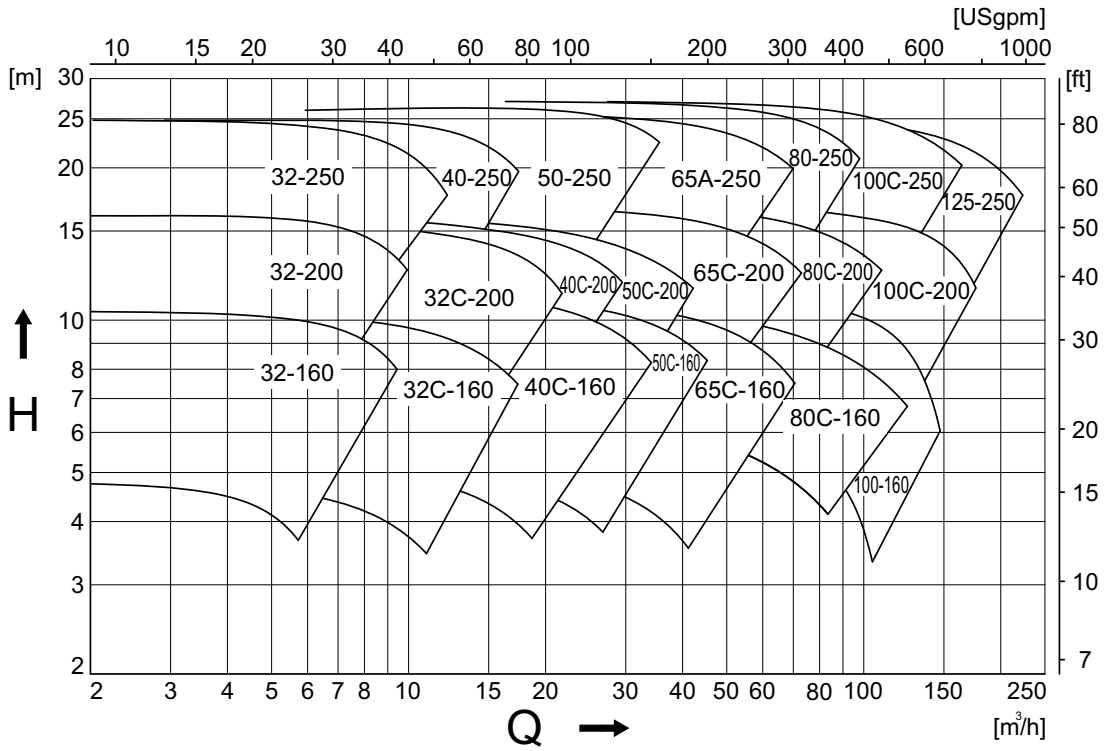

Figure 27: Performance overview 1500 min^{-1}.

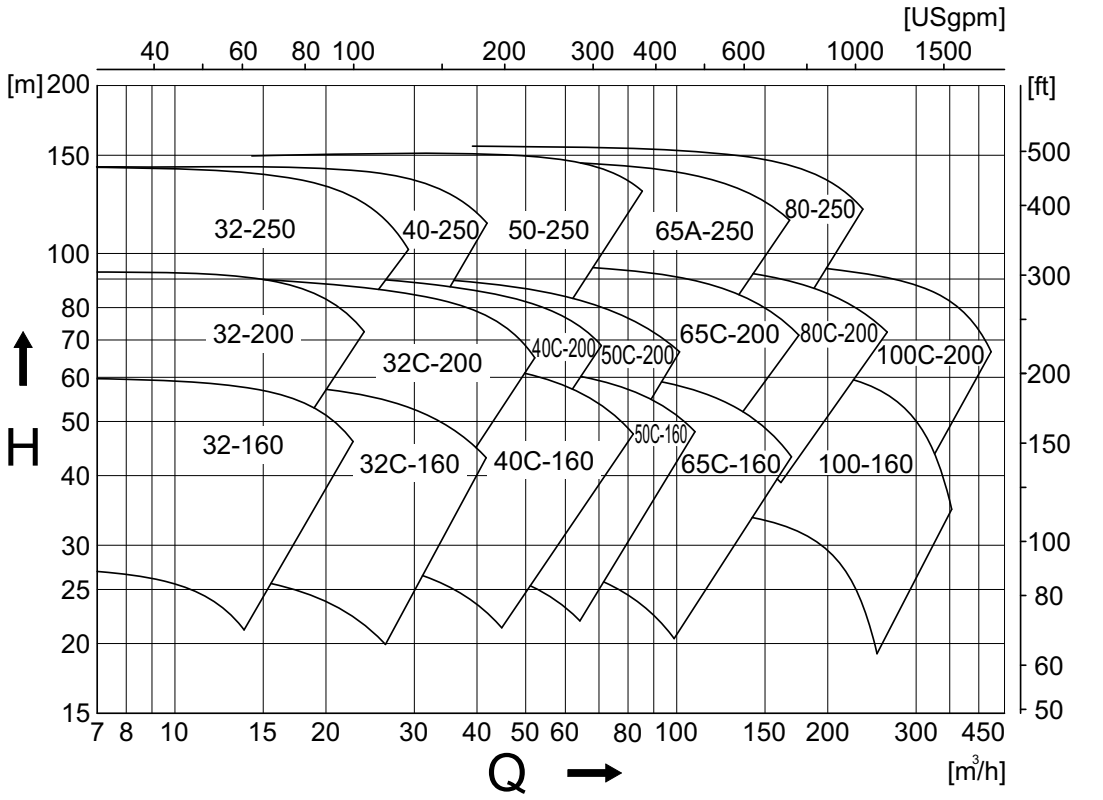

Figure 28: Performance overview 3600 min^{-1}.

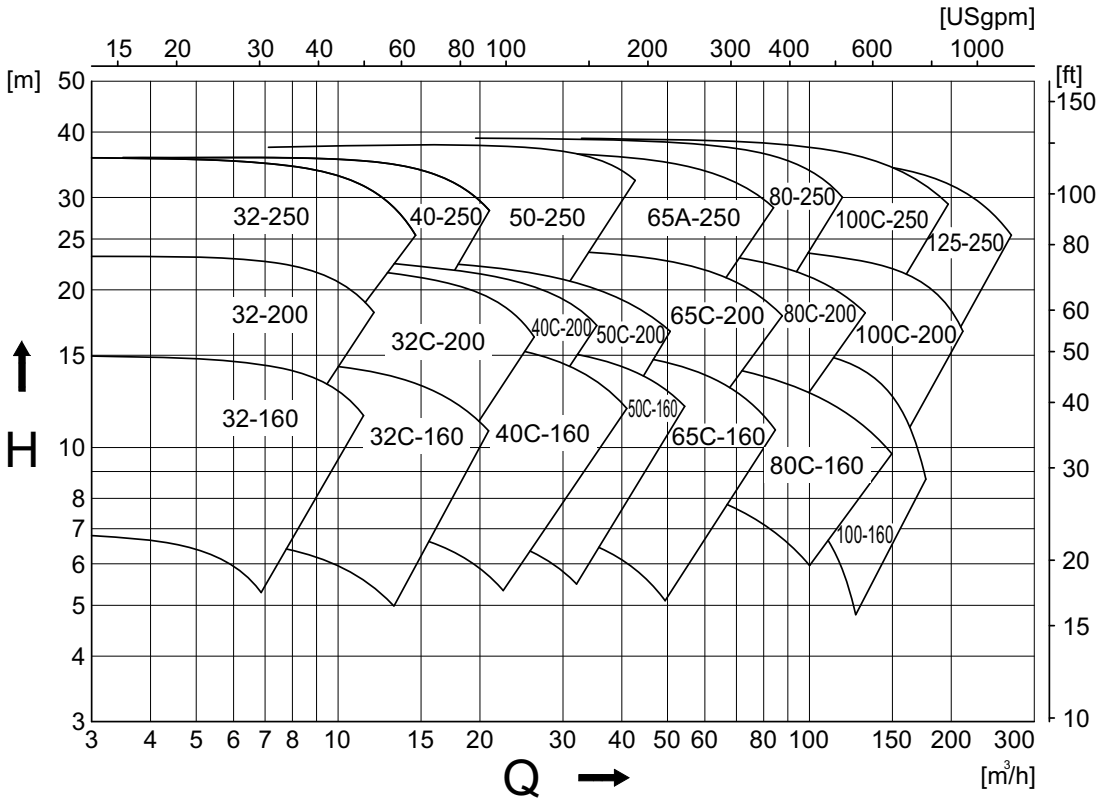

Figure 29: Performance overview 1800 min^{-1}.

10.8 Noise data

10.8.1 Pump noise as a function of pump power

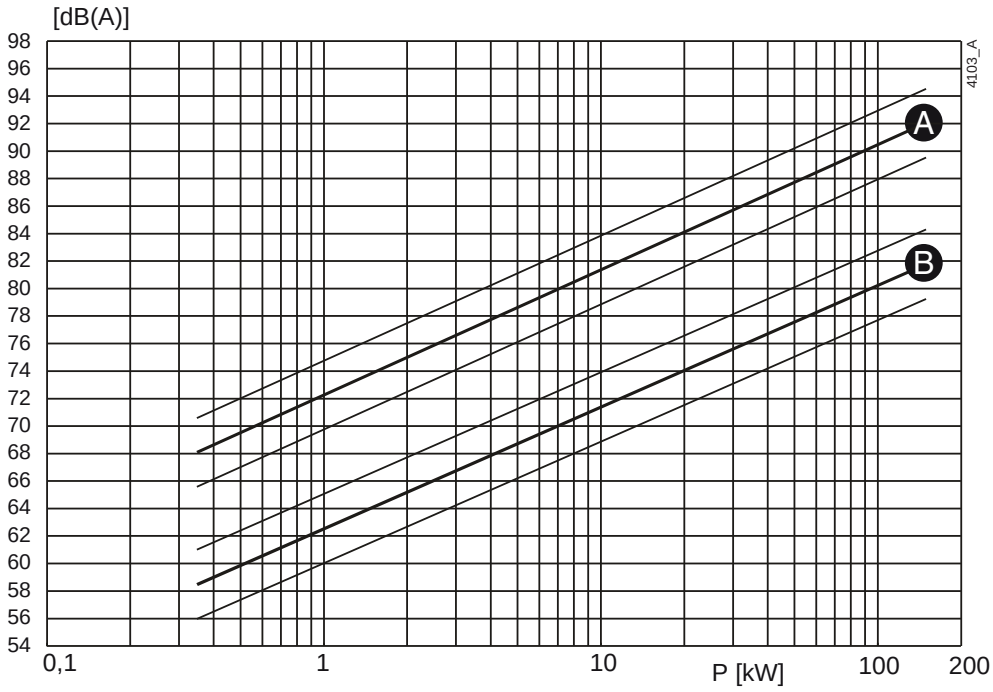

Figure 30: Noise level as function of pump power [kW] at 1450 min^{-1}
A = sound energy, B = sound pressure.

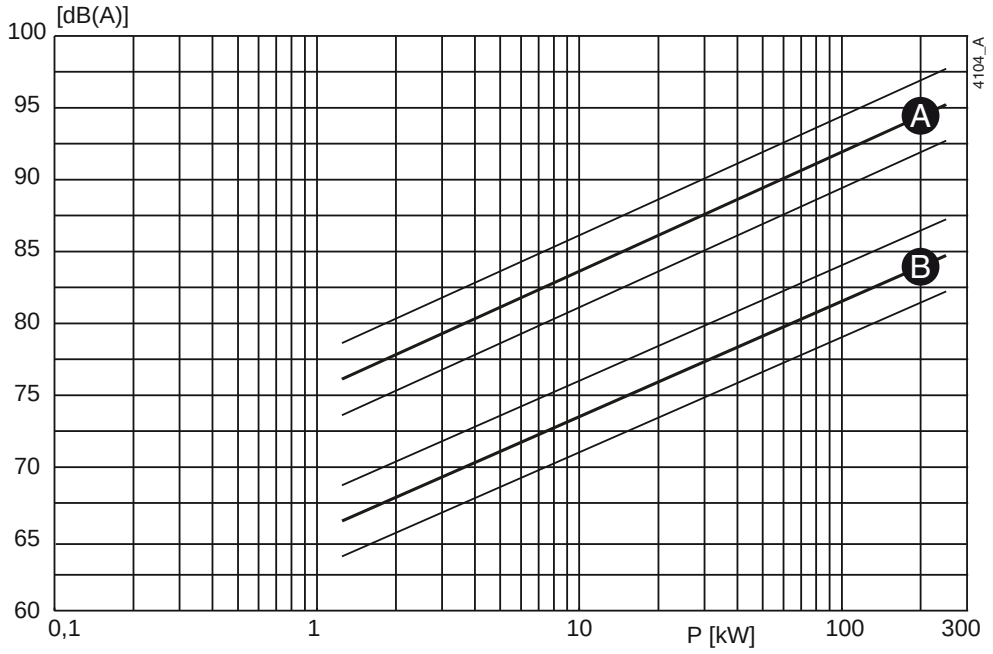

Figure 31: Noise level as function of pump power [kW] at 2900 min^{-1}
A = sound energy, B = sound pressure.

10.8.2 Noise level of entire pump unit

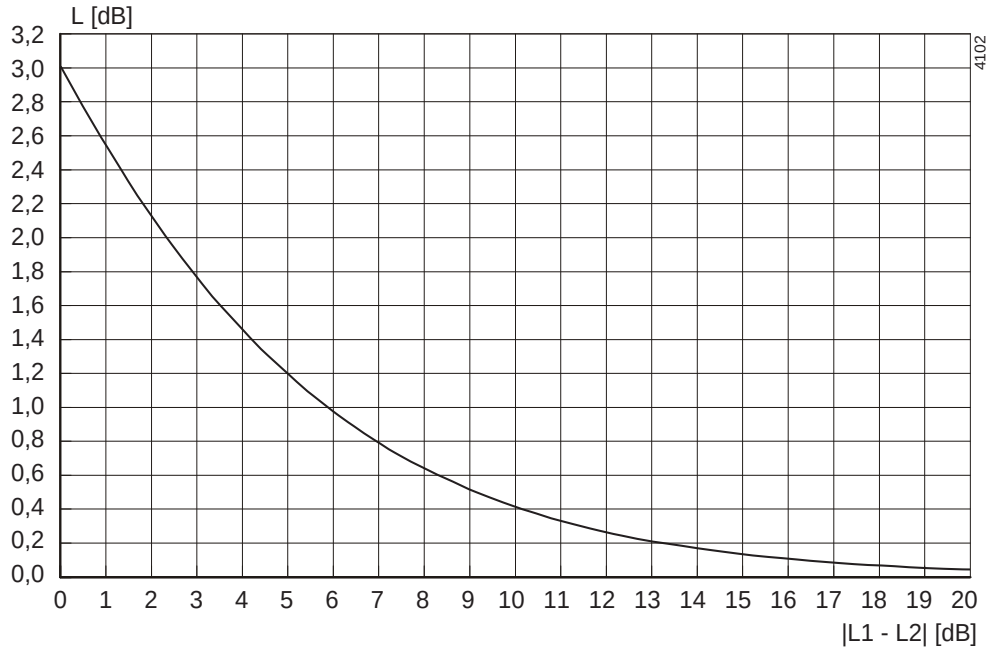

Figure 32: Noise level of entire pump unit.

In order to determine the total noise level of the entire pump unit, the noise level of the motor must be added to that of the pump. This can be easily done by using the graph above.

1 Determine the noise level (L1) of the pump, see figure 30 or figure 31.
2 Determine the noise level (L2) of the motor, see documentation of the motor.
3 Determine the difference between both levels |L1 - L2|.
4 Find the differential value on the |L1 - L2|-axis and go up to the curve.
5 From the curve go left to the L[dB] -axis and read out the value.
6 Add this value to the highest value of both noise levels (L1 or L2).

Example:

1 Pump 75 dB; motor 78 dB.
2 |75-78| = 3 dB.
3 3 dB on the X-axis = 1,75 dB on the Y-axis.
4 Highest noise level + 1,75 dB = 78 + 1,75 = 79,75 dB.

Index

A
Accessories 20
Application area 15
Applications 13

B
Back-Pull-Out system 30
Back-Pull-Out unit
assembling 30
disassembly 30
Bearing groups 14
Bearing L1
assembly 37, 38
disassembly 35
Bearing L2
disassembly 36
Bearings
assembly instructions 37
disassembly instructions 35
lubrication 25

C
Casing wear ring
replacement 33
Combustion engine 21
oil level 23
safety 21
sense of rotation 21
ventilation 23
Construction 15
bearing 15
impeller 15
pump casing 15
shaft seal 15
Coupling
alignment 18
alignment tolerances 19

D
Daily maintenance 25
mechanical seal 25

E
Earthing 17
Electric motor
connection 21
Environment 17
Environmental influences 25

F
Faults 26
Foundation 17

G
Guarantee 10
Guard
assembly 31
disassembly 30

H
Hoisting 11

I
Impeller
disassembly 33
mounting 33
replacement 33
Inspection
motor 23
pump 23

L
Lifting eye 11
Liquid draining 29

M
Maintenance staff 9
Max. allowable working pressure 57
Mechanical seal
assembly instructions 37
with Teflon covered O-ring 37
Monitoring 24

N
Noise 24, 25

O
Operational range 62

P
Pallets 10
Permissible forces on flanges 60
Permissible torques on flanges 60
Piping 20
Precautionary measures 29
Pressure near the impeller hub 59
Pump description 13
Pump unit
assembly 18
commissioning 23
installation 18

R
Re-use 16

S
Safety 9, 17
symbols 9
Scrapping 16
Sense of rotation 23
Serial number 14
Special tools 29
Start-up 24
Static electricity 17
Storage 10, 11

T
Technicians 9
Tightening moments
for bolts and nuts 57
for cap nut 57
Transport 10
Type description 14

V
Ventilation 17

W
Wear ring
assembly 34
disassembly 34
Working switch 21

Order form for spare parts

FAX Nr.	
ADDRESS	

Your order will only be dealt with if this order form has been correctly completed and signed.

Order date:	
Your order number:	
Pump type:	
Execution:	

Quantity	Item. No.	Part	Article number pump

Delivery address:	Invoicing address:

Ordered by:	Signature:	Telephone:

CombiTherm

Centrifugal pump for thermal oil / hot water applications

WHERE IDEAS MEET INDUSTRY

SPX Flow Technology Assen B.V.
Dr. A. F. Philipsweg 51, 9403 AD Assen, THE NETHERLANDS
Phone: + 31 (0) 592 37 67 67 Fax: + 31 (0) 592 37 67 60
E-Mail: johnson-pump.nl@spx.com
www.johnson-pump.com
www.spx.com

For more information about our worldwide locations, approvals, certifications, and local representatives, please visit www.johnson-pump.com.

SPX Corporation reserves the right to incorporate our latest design and material changes without notice or obligation. Design features, materials of construction and dimensional data, as described in this bulletin, are provided for your information only and should not be relied upon unless confirmed in writing.

ISSUED 11/2011 DV-1530
Copyright © 2011 SPX Corporation